INDUSTRY AND POWER

For Executives and Engineers Responsible For Engineered Plant Services

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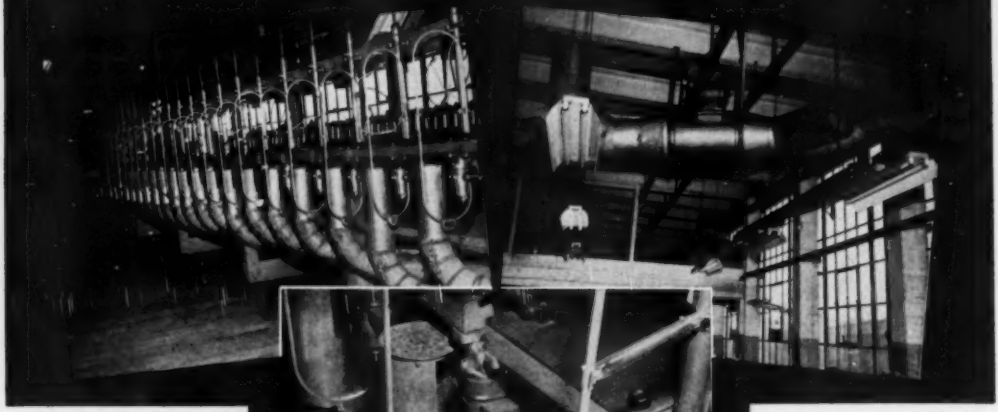
OCTOBER 1952

In Connecticut



Here are the 40 4-inch ducts which ventilate the 40 motors under test. Defective motors still burn out, but only defective motors.

This is the single blower, in a single duct, which applies air to the 40 stations. Plenty of power against pressure.

Application of air to motor is mighty simple, as shown here. Yes, mighty simple . . . but mighty effective, too.

This installation was handled by the Hartzell field office at Fairfield, Connecticut; telephone 9-3340 or 9-3349.

HARTZELL INGENUITY
Earns a Repeat Order

Lack of ventilation caused automobile antenna motors in the plant of a Connecticut manufacturer to burn out far too often on the test stand. A bank of 40 testing stations was involved.

The Hartzell field engineer installed a Hartzell VA21-BD vaneaxial blower in a 21-inch duct, bringing in air from the outside. From this, a 4-inch duct delivers air to each of the 40 motors under test.

How well did it work out? Here's the one best answer: The plant operator is planning to install a duplicate bank of 40 more testing stations. Same blower, same ductwork.

Hartzell is set up to give you a *complete* answer to air-moving problems, simple or complicated, wherever you may be. Fans and blowers which move air economically. Experienced, close-at-hand direct factory field service to make sure you get *results*. That means real money to you. Figure your cost—the money you throw away—if the simplest ventilation job wastes just a half-horsepower.

If something in the air is causing trouble, costing money, don't put up with it. Call your nearby Hartzell field office *now*, or mail the coupon below to us at the factory.

CLIP AND MAIL THIS COUPON NOW FOR INFORMATION

Name_____

Company_____

Street & No._____

City & State_____

If student, check here for special information ☐

PROPELLER-TYPE FANS AND BLOWERS — ROOF VENTILATORS — UNIT HEATERS · ENGINEERING OFFICES IN PRINCIPAL CITIES

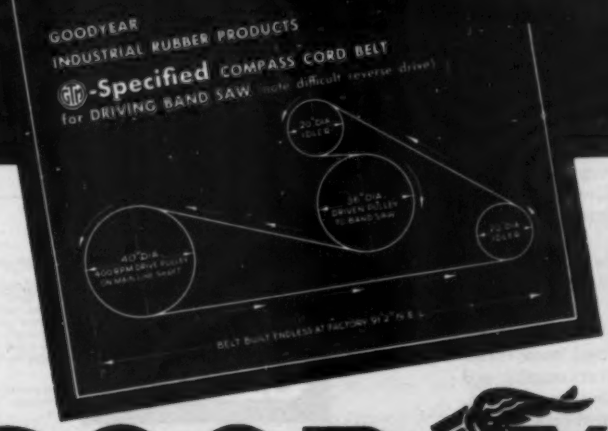
Service doubled

at ⅔ the belt cost

ORDINARY belts on band-saw drive stretched, caused shutdowns and lost production—failed completely after 6 years.

The G.T.M.—Goodyear Technical Man—specified COMPASS CORD belt built with single ply of load-carrying cords. COMPASS has served 13 years so far—still looks good for more service.

The COMPASS belt has never been touched since application—has saved at least $400 to $500 thus far.



FOR HOSE, FLAT BELTS, V-BELTS, MOLDED GOODS, PACKING, TANK LINING, RUBBER-COVERED ROLLS *built to the world's highest standard of quality, phone your nearest Goodyear Industrial Rubber Products Distributor. Look for him in the yellow pages of your Telephone Directory.*

GOODYEAR

THE GREATEST NAME IN RUBBER

It's think you'll like "THE GREATEST STORY EVER TOLD"—Every Sunday—ABC Network

Compass—T. M. The Goodyear Tire & Rubber Company, Akron, Ohio

for producing life-saving Bacitracin

Commercial Solvents simplifies installation with Clark single case centrifugal compressor

Clark No. 2 Standard Multi-Stage Centrifugal Compressor, non-condensing steam turbine driven, and mounted on a steel base with the turbine for permanent alignment.

● When Commercial Solvents Corp. of Terre Haute, Indiana decided to expand facilities for the production of the new antibiotic, Bacitracin, the problem was to obtain a large supply of air that could be easily sterilized. Compressor selection would be determined by the following factors:

Air was to be oil-free.
Steam was to be the source of power.
Available floor space was 7 x 11 feet including aisles!
650 horsepower was required.

An analysis proved a centrifugal compressor would be the correct answer, economically and process-wise if the available space was sufficient. Only Clark could handle the problem because only a Clark compressor could *economically* accommodate the pressure rise in one compressor case.

The reason: Only Clark could supply water cooled interstage diaphragms between impellers, thereby reducing costs tremendously.

Clark solved this problem as it can solve your problem, the simplest way, the least costly way, the best way.

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DIVISION OF DRESSER OPERATIONS, INC.
OLEAN, N. Y.
Offices in Principal Cities Throughout the World

CLARK

multi-stage centrifugal COMPRESSORS

GAS-ENGINE-DRIVEN • STEAM-ENGINE-DRIVEN • MOTOR-DRIVEN • CENTRIFUGAL

Edited specifically for executives and engineers responsible for the selection, installation, operation & maintenance of equipment required for Engineered Plant Services*

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By Engineered Plant Services we mean the providing or generating, transmitting, controlling, applying, and maintaining of POWER, STEAM, MECHANICAL DRIVES, HEAT, ELECTRICITY, AIR, WATER, and other engineered services in and for all areas of the industrial operation. This includes Lubrication, Piping Systems, Industrial Waste Disposal, Corrosion Control, Electrical Systems, Industrial Heat, Coal and Bulk Handling, Dust and Fume Control, and other related services of an engineering nature.

INDUSTRY AND POWER

The Magazine for Engineered Plant Services

VOLUME 63 **OCTOBER 1952** **NUMBER 4**

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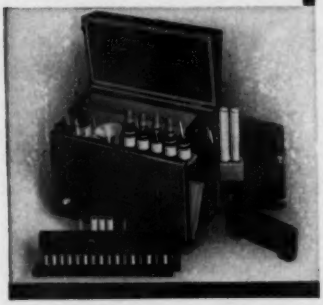
GUARANTEED pH & PHOSPHATE COLOR STANDARDS



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Every Taylor Comparator comes to you with a full set of liquid color standards that carry an *unlimited guarantee against fading.* Moreover, each complete set of color standards is mounted in a sturdy plastic slide, thus eliminating the need for handling fragile single standards.

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Acorns of science

Developments not yet available, but of interest to those responsible for Engineered Plant Services

Bubbles for Building

● Tiny glass balloons, formed when individual grains of clay release gas at the proper moment in a 2700 F atmosphere, may be used for producing lightweight concrete mixes. Development by Armour Research Foundation, sponsored by Kanium Corporation, has resulted in successful methods of manufacture for the material, reported to produce stronger concrete, plaster and plasterboard as well as being much lighter. Particles are generally smaller than those used in ordinary mixes, are nearly spherical and produce a fluid mix, even with low water content, that can be pumped through rubber hose. Other applications are as fillers for plastics, road materials.

Motors at High Temperatures

● The high temperature lubricants developed by the Office of Naval Research in a cooperative study with manufacturers of motors, bearings and lubricants will permit continuous operation of motors at 300 F. Motor design changes will increase relubrication intervals, which are now 500 to 1000 hr. Silicone-lithium soap greases have given good performance for as much as 6000 hr, and for as long as 15,000 hr at 100 F. Factors in future design are seals to prevent grease loss, ball cages of non-ferrous metals, and bearing steels stable at higher temperatures.

Cigar-Size TV Camera Tube

● Industrial, closed circuit television cameras the size of a 16 mm home movie camera are promised by a camera tube, 1 in. in diameter and 6 in. in length, developed by RCA Victor. Cost will also be reduced, for example, small size permits use of many commercially available lenses. The sensitivity allows illumination as low as 100 to 200 ft-c and spectral response approaches that of the human eye. The tube provides 400 line resolution, employs magnetic focus and deflection, and operates on relatively low d-c voltages. The convenience and low cost are expected to increase the number of industrial applications.

Metal to Ceramic Bonds

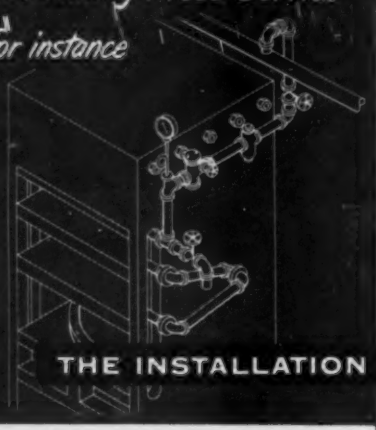
● Brazing of both metallic and non-metallic materials with active metals such as titanium, zirconium, columbium and tantalum is discussed in a report available from the Department of Commerce. The brazing metals wet non-metallic materials as well as other metals, producing exceptionally strong bonds often exceeding the strength of the non-metallic components. Diamonds, sapphires, carbides, various ceramics, refractory oxides, glass, quartz, stainless steel and chrome-iron alloys are among the materials joined. Better degassing in electronic industries and better cutting tools are possibilities.

Information by Reflection

● Most methods using radioactive materials for inspection and detection depend on transmission of rays through the material. In one method being used in oil well exploration and reported by Isotope Products Limited, however, radium and beryllium, a combination which gives off neutrons, is lowered in a well already cased in steel pipe. The neutrons penetrate the steel and are partially reflected in a pattern that varies with rock, shale, water, sand or oil. The detector, on the same side of the steel as the source, transmits the information to the well head where it is recorded for subsequent study.

Will Your Pressure Regulators Last 25 Years?

...on Molding Press Service for instance



THE INSTALLATION

Crane Brass Pressure Regulators on steam lines to rubber molding presses; Dryden Rubber Division, Sheller Mfg. Corp., Chicago. 225 units in service.

VALVE SERVICE RATINGS

FEATURES:	Equally good on steam or air
SUITABILITY:	Steady outlet pressure - No drift
MAINTENANCE COST:	Routine servicing only
SERVICE LIFE:	Many installed more than 25 years — Still O.K.
OPERATING RESULTS:	Fully automatic steam control at lowest cost
PRICE:	Good Buy - has no equal
AVAILABILITY:	Stock item in Crane Line

THE HISTORY

Steam generated at 130 psi is reduced through individual regulators on molding presses. Pressure used at machines is 60 to 100 psi depending on work. Features of regulator service needed most are: (1) non-fluctuating outlet pressure automatically maintained within close regulation; (2) easy adjustment by press operator to specified pressure for given work.

More than 25 years ago the plant standardized on Crane Regulators, a total of 225 being in use today. Many are the original installations, still delivering desired outlet pressure. Records for all regulators, regardless of age, show no maintenance cost other than prescribed simple routine servicing. On old models of the Crane 960 regulator, after prolonged service, this includes occasional regrinding of seats.

THE VALVE

Crane No. 960 Brass Pressure Regulators reduce steam or air pressures up to 250 psi, to within 80% of inlet pressure. Factory pre-set to operate within any of 4 ranges from 1 to 200 psi, with easily selected service pressure within set range. Precision made; fully automatic; highly dependable, even under reasonable fluctuation of inlet pressure. All wearing parts renewable. See your Crane Catalog or Crane Representative for full data.

The Complete Crane Line Meets All Valve Needs. That's Why—

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CRANE CO., *General Offices:* 836 S. Michigan Ave., Chicago 5, Illinois

Branches and Wholesalers Serving All Industrial Areas

VALVES • FITTINGS • PIPE • PLUMBING • HEATING

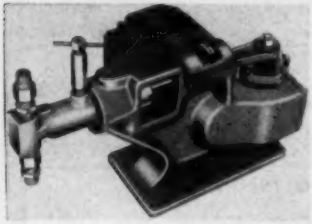
New equipment and developments

Highlights of new products by leading manufacturers

Each new product item has a key number for your convenience in asking for additional, detailed information. Insert key number on return post card on page 131

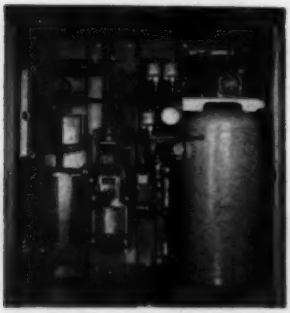
1—Chemical metering pump has built-in motor

Accurate feeding of chemical solutions of low capacity and medium pressure is provided by the Model X-52 Adjust-O-Feeder, according to the manufacturer, %Proportioneers, Inc.%. A built-in oil enclosed gear reduction and integral motor are incorporated. Capacity of the metering pump is adjustable within a range of 0.5 to 5 or 1 to 10 gph, discharging against pressures to 650 psi. Construction is described in a bulletin.



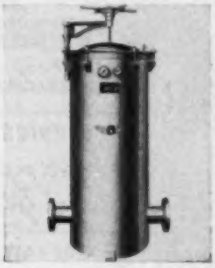
2—Pneumatic mechanism closes circuit breakers

To provide increased energy for quick closing and reclosing of high interrupting capacity circuit breakers, Westinghouse Electric Corp. has developed a pneumatic closing mechanism. The unit is said to be more powerful than solenoid types. Two sizes are available: type AA-7 and AA-10 with 7 and 10 in. pistons respectively. They are used with breakers ranging from 14.4 kv, 500,000 kva through 230 kv, 15,000,000 kva. Construction is described in a 14-page bulletin.



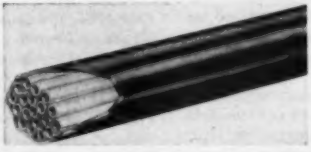
3—Filter uses throw-away cartriges

Developed by United States Hoffman Machinery Corp. for full flow filtration of diesel lubricating oil, the Flowmaster cartridge filter is said to remove particles down to 20 micron and smaller. Ten sizes offer flow rates from 75 to 900 gpm, based on an initial pressure drop of 5 psi with 150 SSU oil. The unit also can be adapted for use with industrial mineral oils, soluble oil coolants and water solutions. Specifications are listed in a data sheet.



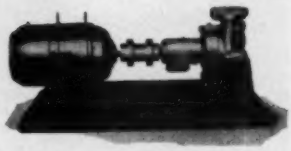
4—Instrument tubing is corrosion-proof

Resistance to corrosion is an important advantage of Impervapak Poly-Cor, an instrument tubing harness developed by the Dekoron Tubing Div. of Samuel Moore & Co. A sheath of high molecular weight plastic is extruded over a bundle of plastic tubes to form the product. Said to carry all standard instrument line pressures, it is supplied with 4, 7, 10, 14 or 19 tubes of ¼ in. OD and ⅛ in. ID. Various colors are available for identification.



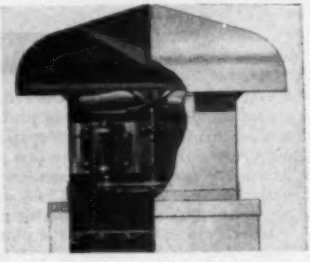
5—Pumps incorporate mechanical shaft seals

Ingersoll-Rand Co. has announced development of the class SFLA pumps for handling light refinery liquids at temperatures to 250 F. A Cameron mechanical shaft seal, which eliminates need for a stuffing box, is incorporated as standard equipment in the single stage, vertically split design. Sizes of 1, 1½, 2, 3 and 4 in. are available for capacities to 1000 gpm and pressures to 600 psi. Construction is described in a 16-page catalog.



6—Ventilator features low silhouette

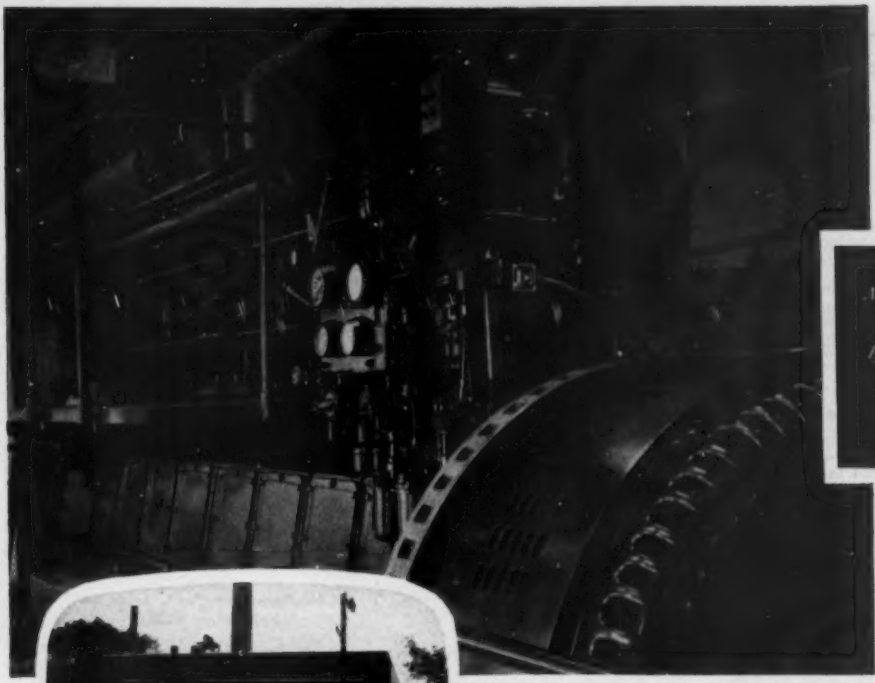
To meet architectural specifications requiring low height and inconspicuous design, The Burt Manufacturing Co. has announced a low type fan ventilator. It is said to be equally efficient when used either as an exhaust ventilator or as a fresh air supply unit. Fan sizes range from 12 to 60 in. with either direct motor or V-belt drive. Advantages are listed in a bulletin.



7—Insulation tape has high thermal conductivity

Dow Corning Corp. has announced improvements in Silastic R tape which make it stronger, tougher, more moistureproof and oil resistant. It is easily vulcanized into a one-piece resilient jacket. As an insulation, the tape permits higher ratings on electrical equipment and is said to retain its physical, chemical and dielectric properties from -70 to over 500 F. Thicknesses of 10, 15 and 20 mils are available. Data sheets give complete information.

(Continued on page 10)



Another Example of Efficient Power at Lower Cost

Tecumseh Electric Plant, Tecumseh, Nebraska, where latest addition is the efficient Cooper-Bessemer gas-diesel shown above.

Why Tecumseh's Cooper-Bessemer Gas-Diesel gets no rest . . .

FOLLOWING conversion from steam to diesel back in 1925, Tecumseh's electric plant has been adding new diesels as load demands grew. Latest is the 8-cylinder Cooper-Bessemer supercharged JS gas-diesel shown here . . . added in 1950.

This engine is kept in virtually continuous operation for 2 simple reasons. First, it has demonstrated the dependability and need for only minimum down time that makes it the logical engine with which to meet base power demands. Second, it's the economical thing to do! Month in, month out, the operating cost has been surprisingly low . . . as low as 3.3 mills per kwh. In plant after plant, Cooper-Bessemer gas engines, diesels and gas-diesels are showing exceptional records of dependability and economy. The nearest Cooper-Bessemer office will be glad to give you interesting facts on actual operation under conditions similar to yours.

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Seattle, Wash. Shreveport, La. St. Louis, Mo. Los Angeles, Calif.
Caracas, Venezuela Gloucester, Mass. Tulsa, Okla. New Orleans, La.

New equipment and developments

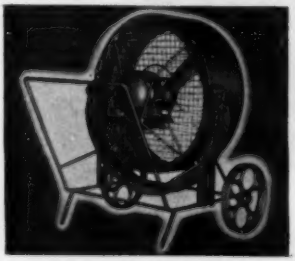
(Continued from page 8)

8—Valve operator is diaphragm type

General Controls Co. has developed a diaphragm type valve operator for use on any of the company's normally open, normally closed, 3-way or slide type valves. The unit, which operates by pneumatic pressure, is adaptable for manual or remote control systems. Operators are available with 13 or 16 in. diaphragm sizes.

9—Utility fan is mounted on wheels

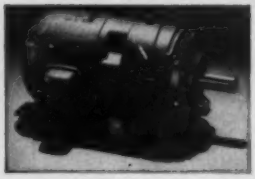
Hartzell Propeller Fan Co. has designed a utility fan on wheels for use where locations must be changed fre-



quently. The weight is said to be distributed to prevent "walking" and yet allow easy handling. The fan can be turned vertically in a complete circle and locked into any position. Suggested uses include kiln cooling and blasting hot spots in machines. Sizes of 24, 32 and 36 in. are available.

10—Gear motor design simplifies maintenance

Three piece construction, incorporated in a gear motor developed by General Electric Company's Small and Medium Motor Dept., is said to permit quick removal of defective stators without disturbing gear components or



gear connections to the load. The gear is a recently developed planetary type with ratings of 780 to 13.5 rpm. Ventilation openings at the bottom provide dripproof construction. Standard motor ratings are 1 to 75 hp, with units for special applications up to 200 hp.

TO REQUEST ADDITIONAL FREE DATA

Insert " key" numbers on return post card found on page 131. Our Reader's Service Department will handle your request promptly

12—Hydraulic jack has positioning handles

Hein-Werner Corp. has designed a 50 ton hydraulic jack said to be well suited for straightening and leveling

operations, heavy duty compressing and moving heavy equipment. Positioning handles, which fall flush against housing when not in use, are furnished to facilitate carrying and positioning. The base is drilled for a pressure gage.

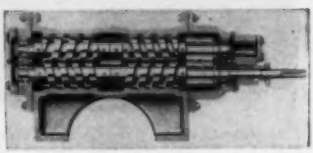
13—Steam cleaner uses plant steam lines

Existing plant steam lines furnish heat and pressure for the model 51 fireless steam cleaner developed by

Malsbary Manufacturing Co. A variable volume pump maintains a steady, high pressure cleaning stream even when steam is low. At full capacity, the unit delivers 200 gph of solution at temperatures to 212 F and pressures to 90 psi. The solution tank holds 50 gal. Both stationary and portable models are available for 110 v operation.

14—Pump handles lubricating fluids

For positive displacement of lubricating fluids or semi-fluids, the Sier-Bath Gear and Pump Co., Inc., has announced development of an internal gear and bearing type screw pump.

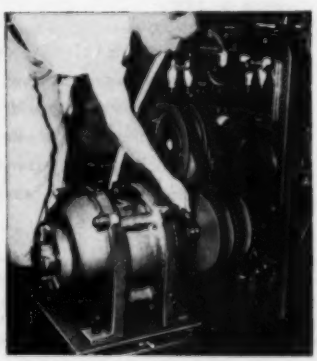


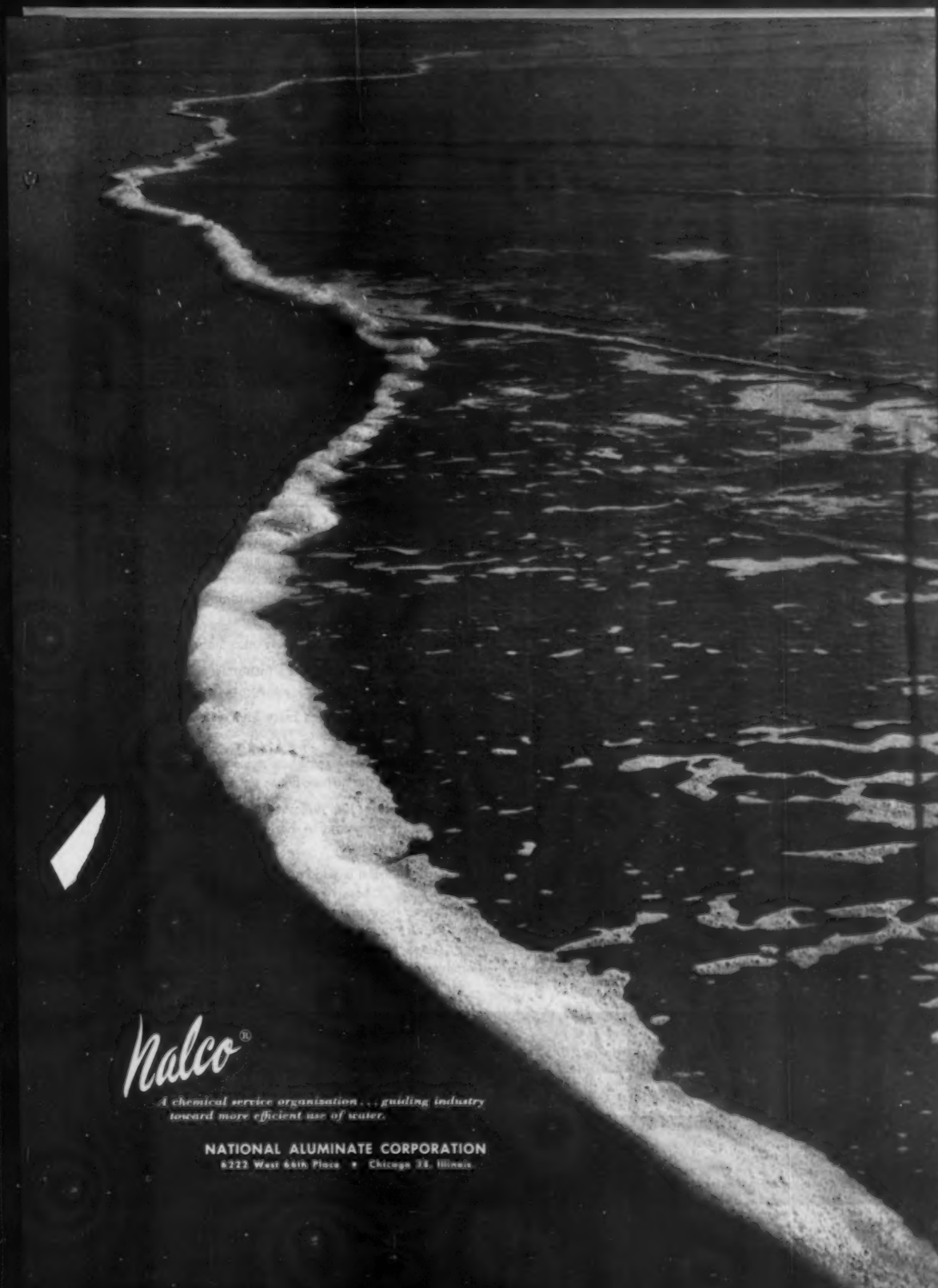
Capacities range from 1 to 700 gpm and discharge pressures are 1000 psi for viscous liquids and 500 psi for light oils. Direct connection can be made with motors up to 1800 rpm.

(Continued on page 14)

11—Variable speed drive features ease of adjustment

Down-time for speed changes has been reduced by design features incorporated in a variable speed drive developed by Dodge Manufacturing Co. Components include a variable pitch motor sheave, a companion sheave, a set of wide range belts and a slide motor base. The Taper-Lock principle has been incorporated in both sheave bushings to increase speed and ease of making speed changes. The variable sheave assembly locks on the motor shaft with the turn of a screw. Pitch diameter is varied by an adjusting screw located at either end of the sheave. This is said to allow accurate settings and permit speeds to be held to close limits. A slide motor base preserves belt tension when speeds are changed.




Nalco®
A chemical service organization . . . guiding industry toward more efficient use of water.
NATIONAL ALUMINATE CORPORATION
6222 West 66th Place • Chicago 38, Illinois

ABRASION

Used under the toughest abrasion conditions known, our CARBOFRAX silicon carbide refractories or our MONOFRAX fused cast refractories have definitely outworn metals, paving bricks and other normally durable materials. For example:

In Cyclone Dust Collectors where the blast of millions of highly abrasive particles quickly cuts away other lining materials.

In Coke Chutes and Hoppers which must withstand punishing cascades of sharp-edged coke—sometimes fiery hot.

In Hot Blast Mains which carry high velocity gases that are laden with very abrasive dust.

In Billet Heating Furnaces where massive metal slabs are pushed or dragged across the furnace floor or other bearing surfaces.

Under conditions like these, regular lining materials or bearing surfaces are worn away in short order. Not so, these two Super Refractories. They last.

Granted, abrasion is seldom an isolated condition. It's usually abrasion *plus* . . . heat, or acid attack, or some other condition. But whatever the combination of conditions, chances are, there's a Super Refractory to fit the bill. For, as you can see (box, opposite page), these materials have many other properties equally as desirable in certain applications as abrasion resistance.

Super Refractories by

CARBORUNDUM

Trade Mark

Refractories Division

Perth Amboy, N. J.

"Carborundum", "Carbofrax" and "Monofrax" are registered trademarks which indicate manufacture by The Carborundum Company.

SUPER REFRACTORIES ARE ALSO USED

WHERE HEAT CONDUCTIVITY IS NEEDED. At elevated temperatures CARBOFRAX refractories conduct heat *almost as rapidly as chrome-nickel steels!* This characteristic is invaluable in checkers, muffles, hearths, radiant heating tubes, etc. It often radically increases the capacity of the equipment. There are also Super Refractories which are very good insulators, particularly at high heats.

WHERE CHEMICAL ACTION IS PRESENT. In general, all Super Refractories are either neutral or acid in nature. They are widely used where chemical inertness is important.

WHERE STRENGTH IS IMPORTANT. No commercial tonnage refractories have greater strength than Super Refractories. All can withstand over 300 psi at 2750° F without crushing. The modulus of rupture of one composition averages 3100 psi at 2460° F.

WHERE HIGH HEAT IS INVOLVED. They can be safely used at temperatures over 3000° F. They are very durable—are highly resistant to spalling and cracking. Some varieties are almost indispensable where flame impingement or violent temperature changes are present.

that will cut through metal

hardly touches these materials

They're the toughest known materials for large scale commercial use—so tough, they'll quickly wear out the best grinding wheels.

Have you any spots in your equipment that are vulnerable to abrasion? Areas that need constant relining or replacing? Then don't fail to investigate our CARBOFRAX bricks and shapes, and our MONOFRAX K blocks. Both materials give "armor-plated" protection. Both are extremely hard—within one index point of diamond hardness!

Possessing properties seldom associated with refractories, these, and other Super Refractories by CARBORUNDUM, are often used *regardless of whether high temperatures are involved.* Great strength and durability plus high resistance to heat, corrosion and abrasion, make them ideal for a wide range of applications.

It's surprising how often you'll find places in your equipment where Super Refractories are inherently better—and less expensive—than other materials. They're well worth investigating, particularly in this period of scarce critical materials.

Why not check up? Practically all Super Refractories are available as bricks or special shapes molded to close tolerances—including fitted joints, tubes, etc. Send today for our booklet describing the properties of these unique materials.

Information is now available on all the various groups of Super Refractories by CARBORUNDUM. Just send the coupon for our new booklet. No obligations, of course.

Dept. X-102
Refractories Div., The Carborundum Co.
Perth Amboy, New Jersey

Please send your free booklet describing the principal properties of Super Refractories.

Name_____

Position_____

Company_____

Street_____

City_____ Zone____ State_____

New equipment and developments

(Continued from page 10)

15—Voltage tester uses one test lead

Holub Industries, Inc. has designed a voltage tester having only one test lead. Known as Hi-Test, it indicates a-c or d-c voltage from 115 to 600 v. The second test prod is permanently mounted in one end of the unit, making it easy to hold the tester in one hand while pressing the prod firmly against contact or wire. The voltage scale, a drum type protected by a magnifying lens, is located in the opposite end. Flashover between ends of the solenoid coil is said to be eliminated since the wires are brought out of the case at opposite ends of the coil. Overall length of the tester is 8½ in. A data sheet describing the unit is available.

16—Humidifier is self-contained

Automatically controlled humidification is provided by the type E unit humidifier manufactured by The Bahnson Co. Water is atomized and distributed horizontally. The unit, which is suspended from the ceiling, will evaporate up to 3 gph, said to be sufficient for

several thousand cubic feet at normal conditions. Specifications are listed in a data sheet.

17—Fire extinguisher provides one hand operation

For use on burning liquids, live electrical fires and small combustible fires, The Fyr-Fyter Co. has developed the pressurized model B vaporizing liquid fire extinguisher. Liquid is completely discharged in 17 to 25 sec by the force of pressurized nitrogen. Elimination of pumping or other manual operation is

said to provide increased control when aiming the stream. One and two quart models are available.

TO REQUEST ADDITIONAL FREE DATA

Insert " key" numbers on return post card found on page 131. Our Reader's Service Department will handle your request promptly

18—Fuel oil heater uses gas

An automatically controlled gas flame is used in the type GF Paracoil fuel oil heater, developed by Davis Engineering Corp., to generate low pressure steam. The steam passes in a closed circuit through the oil heating section. Manufactured, natural or bot-

tled gas can be used. Applications include kilns, ovens and dryers where steam is not available. When serving an oil fired boiler, it eliminates the possibility of boiler water contamination due to leaks. Literature describing the unit is available.

19—Miniature circuit breaker replaces standard fuses

Mini-Breaker, a miniature branch circuit breaker developed by Mechanical Products, Inc., can be installed in any standard Edison base fuseholder delivering 110-125 v a-c service. This fully rated, thermally actuated circuit breaker can be applied as a direct replacement on existing fuse-protected cir-

cuits of 15, 20 or 30 amp ratings. Operating and construction features are dealt with in a 4-page folder.

20—Raceway has closely spaced outlets

Plugmold 2000 multi-outlet raceway system makes electrical power more accessible, according to the manufacturer, The Wiremold Co. Convenience outlets are provided every 30 in. in a continuous run. Shorter lengths of closely spaced receptacles also are available. The system is designed to accept receptacles for the following wiring systems: NEMA grounded 2-wire; Duplex 2-wire with two live wires; and Duplex 3-wire with one side switched and one live wire. The raceway is easily mounted on any surface.

21—Industrial fan has many applications

Three wheel types designed for handling various materials are available in an industrial fan designed by Westinghouse Electric Corp., Sturtevant Div. An air handling wheel, for exhausting smoke, fumes and light dusts, features

high efficiency over a wide capacity range. A materials handling wheel is available for sawdust, granular materials and chips, while a long shavings wheel has been designed for handling long stringy fibers. Units are made in 11 sizes, ranging from 670 to 44,000 cfm for pressures to 16 in. wg.

(Continued on page 22)

Modern power plant practice demands a water conditioning program that produces only the ultimate in trouble-free and efficient boiler operation.

External softening and the use of conventional inorganic treatments are recognized requisites. However, the supplementary use of organic agents may well assure the difference between long, uninterrupted operation and frequent boiler outages due to scale and sludge formations.

Take the case, for example, of a large electrical manufacturer, who called in Betz 14 years ago to treat its new power plant. This plant operates at 900 pounds pressure with 50% make-up polluted river water. Betz recommended the use of organic agents to supplement the external softening and inorganic treatment.

Here are the results from the record: In the entire 14 years operation of these boilers, they have never been turbined or acid cleaned and no difficulties from feedwater conditions have occurred! What's more, excellent steam purity is produced and turbine blading is completely clean.

This plant could easily be your plant—operating efficiently, free from frequent boiler outages through the effective use of Betz *Specialized* Water Conditioning Service. Why not call on Betz today for an interesting discussion of your water problems? There's no obligation, of course. W. H. & L. D. BETZ, Gillingham & Worth Streets, Philadelphia 24, Pa. In Canada: Betz Laboratories Limited, Montreal 1.

Send today for Betz Technical Paper No. 98, "Boiler Scale—Its Formation and Prevention." It's free.

BETZ

CONSULTANTS ON ALL WATER PROBLEMS

"WE SAVE $9,000 A YEAR—

"NEW COAL INSTALLATION SAVES US 31.9%—43¢—ON EVERY THOUSAND POUNDS OF STEAM!"

says Mr. Robert W. Paul, Heating Engineer, the University of Akron, Akron, Ohio.

This architect's drawing shows the University of Akron's new steam plant. It is located in a residential neighborhood and operates well within the bounds of extremely tight smoke and dust regulations. The plant burns about 1,450 tons of *bituminous* coal a year, has a steam capacity of 28,000 lbs. per hour. For about $26,000 a year, this new plant does the work that would have cost $35,000 under the old one.

Planning to modernize? Building a new plant? In either case an up-to-date coal installation can save you lots of money!

Labor costs are cut to a minimum with modern coal- and ash-handling systems. And modern combustion equipment gives you more steam for every dollar—10 to 40% more power from every ton of coal!

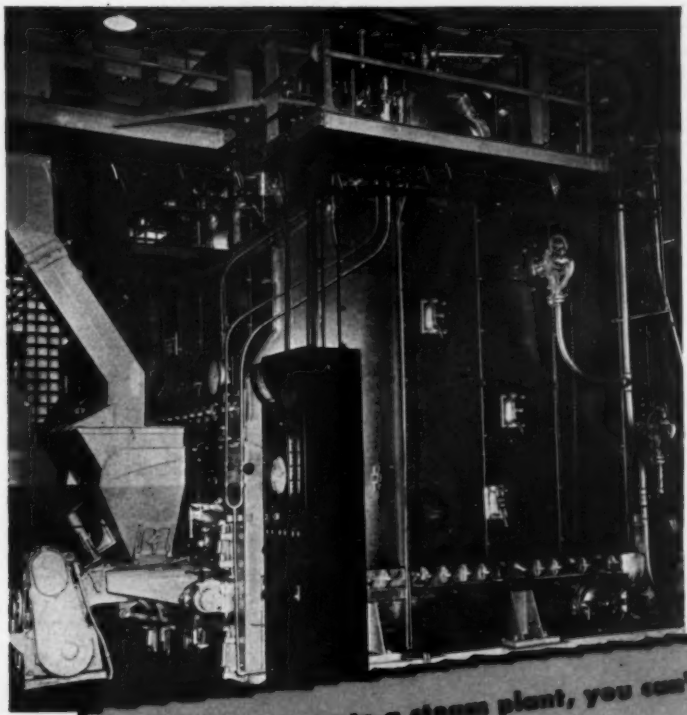
A consulting engineer can show you how these savings really mount up—and mount up fast—when you burn coal in a modern plant designed to meet your *specific* needs.

And coal's your best bet for the future, too. Of all fuels, coal alone has virtually unlimited reserves. And America's coal is mined by the most productive and efficient coal industry in the world. That's why coal offers greater price stability and more dependable supply than any other fuel!

BITUMINOUS COAL INSTITUTE
A DEPARTMENT OF NATIONAL COAL ASSOCIATION
WASHINGTON, D. C.

FOR HIGH EFFICIENCY FOR LOW COST

AND HEAT MORE SPACE—BY BURNING COAL THE MODERN WAY!"



NO SMOKE CONDITION... NO DUST NUISANCE— THANKS TO BURNING AND HANDLING COAL WITH UP-TO-DATE EQUIPMENT!

This view shows Akron's two new stoker-fired boilers. Coal is delivered by truck through a hopper and into a dust-tight room. Ashes are removed pneumatically. The old equipment delivered a thousand pounds of steam at a cost of $1.35. This new installation has cut this cost nearly ⅓. Now Akron gets a thousand pounds of steam for only 92 cents!

If you operate a steam plant, you can't afford to ignore these facts!

COAL in most places is today's lowest-cost fuel.

COAL resources in America are adequate for all needs—for hundreds of years to come.

COAL production in the U.S.A. is highly mechanized and by far the most efficient in the world.

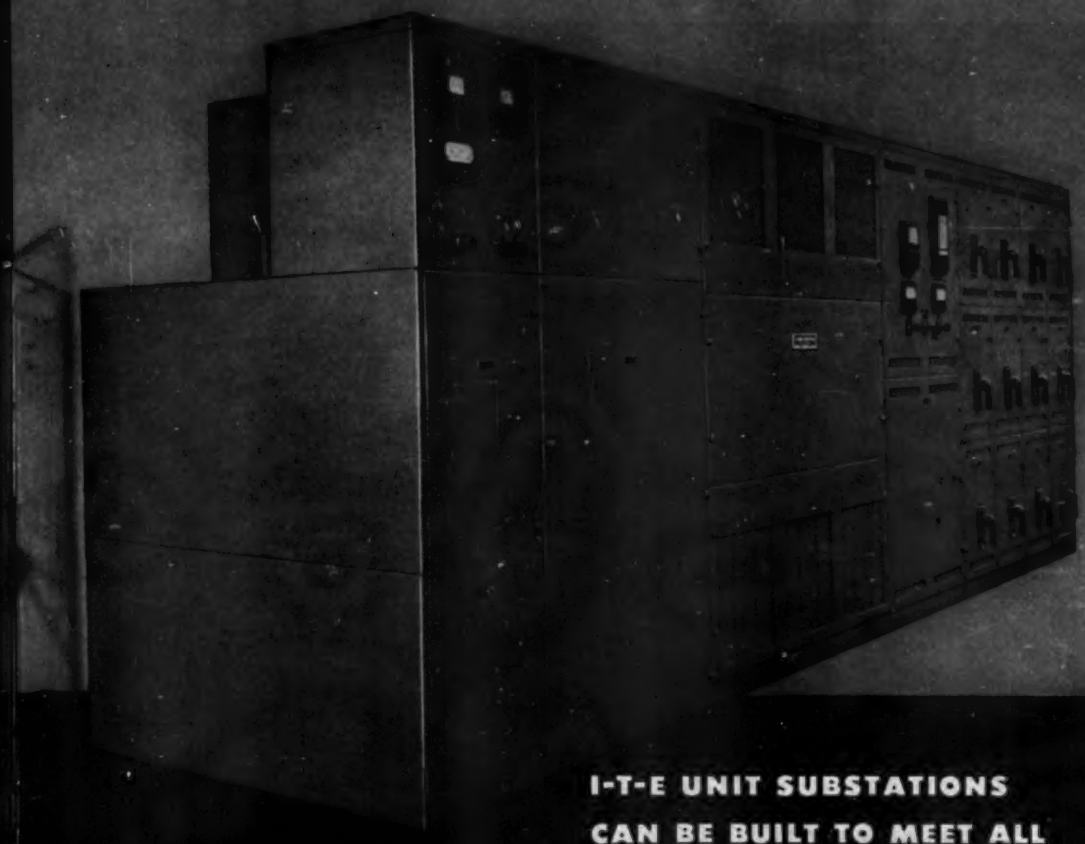
COAL prices will therefore remain the most stable of all fuels.

COAL is the safest fuel to store and use.

COAL is the fuel that industry counts on more and more—for with modern combustion and handling equipment, the inherent advantages of well-prepared coal net even bigger savings.

YOU CAN COUNT ON COAL!

HOW MUCH WOULD A POWER



TRANSFORMER TYPES INCLUDE:
OISC
Non-inflammable liquid-filled
Class B air-cooled (illustrated above)
Class H air-cooled
Class H, nitrogen-filled, sealed tank

I-T-E UNIT SUBSTATIONS CAN BE BUILT TO MEET ALL NEMA "USUAL and UNUSUAL" SERVICE CONDITIONS

Indoor and outdoor – in any required ratings

YOU SAVE THROUGH –

1. Better voltage at point of use.
2. Lower conductor cost – shorter runs of LV cable.
3. Shorter installation time – Substations shipped as complete packages.
4. Use of lower interrupting capacity breakers.

GET THE FULL STORY –
See your local I-T-E representative for details – or write for Catalog Section 9000 today.

FAILURE COST YOUR PLANT?

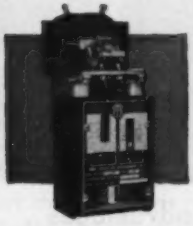
Suppose a prolonged power interruption suddenly hit your plant! How much would it cost you in lost production, down-time—perhaps ruined product, equipment damaged beyond repair?

To all plants, *service continuity* means profits. In some, service continuity is the most important single consideration in planning the vital electrical distribution system.

Assure service continuity—Install modern I-T-E Unit Substations

No matter what your service continuity requirements may be, I-T-E can offer you the benefits of long experience—supply the equipment to meet them all. You get:

FLEXIBLE SYSTEM PLANNING. *Sectionalization* (I-T-E Unit Substations strategically spotted throughout the plant) *limits* the area affected by power interruption. You can plan your system to provide immediate restoration of service—or actual *elimination* of interruption on unaffected circuits.



SELECTIVE TRIPPING. Sectionalization can be carried right down to the *individual* I-T-E circuit breaker—the individual machine or feeder. The versatile I-T-E Direct-Acting Selective Overcurrent Trip Device helps *isolate* faults. If there's a sustained overcurrent or short circuit in any branch of the system, only the breaker closest to the fault will open.

MODERN DRAWOUT CONSTRUCTION. Even maintenance requires little or no down-time. With modern I-T-E drawout construction, total outage time during maintenance is only a few minutes. Circuit breakers of like characteristics are interchangeable. One spare breaker—for quick replacement—provides economical insurance for a number of feeder circuits.

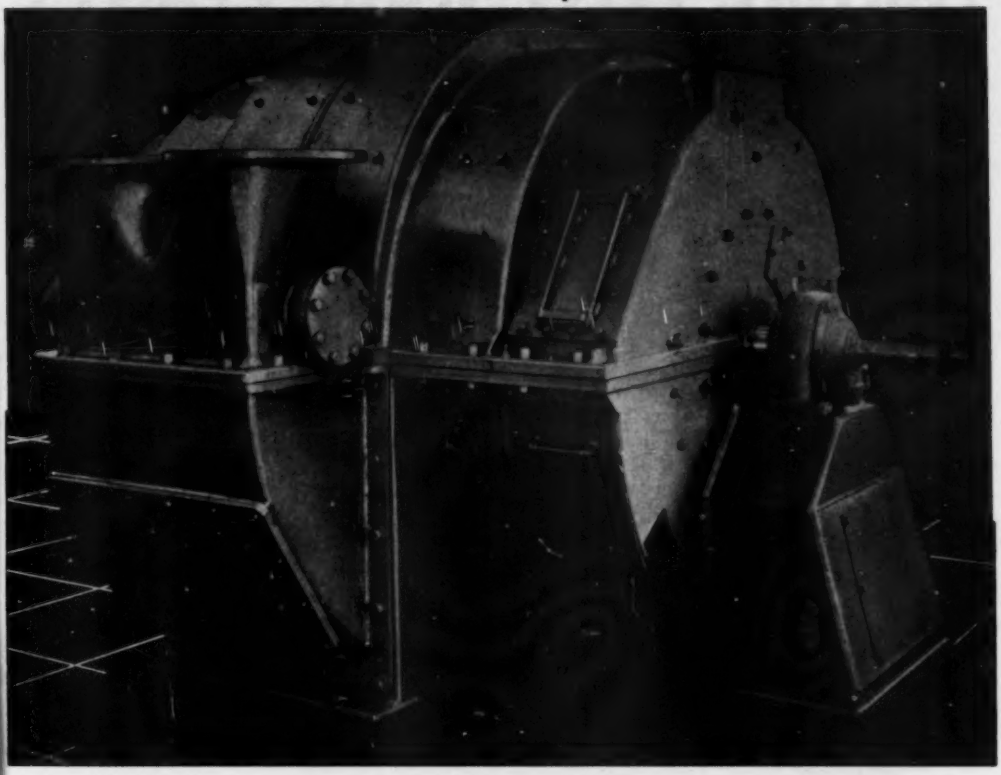
I-T-E

UNIT SUBSTATIONS

I-T-E CIRCUIT BREAKER CO. • 19TH & HAMILTON STS. • PHILA. 30, PA.

CANADIAN MFG. & SALES: EASTERN POWER DEVICES, LTD., TORONTO • EXPORT SALES: PHILIPS EXPORT CORP., N. Y. 17, N. Y.

Performance of Riley "50" Pulverizers



Riley "50" Pulverizers give you all these other significant advantages . . .

- Quiet vibrationless operation
- Flexibility—wide load range
- Ability to carry extremely low loads
- Low power consumption
- Ease of regulation
- Small space required
- Minimum foundation cost
- Parts easily renewed
- Can be operated without coal feed
- Ease of ignition
- Low lubrication cost
- No worms or gears—Just two bearings
- High primary air temperatures
- Low maintenance

The Riley "50" Pulverizer is the latest development in the coal pulverizing field. It is the only pulverizer using tungsten carbide parts to assure long periods of continuous operation and low maintenance. It will pay you to investigate Riley "50" Pulverizers when considering this type of equipment.

TRADE MARK Rx REGISTERED

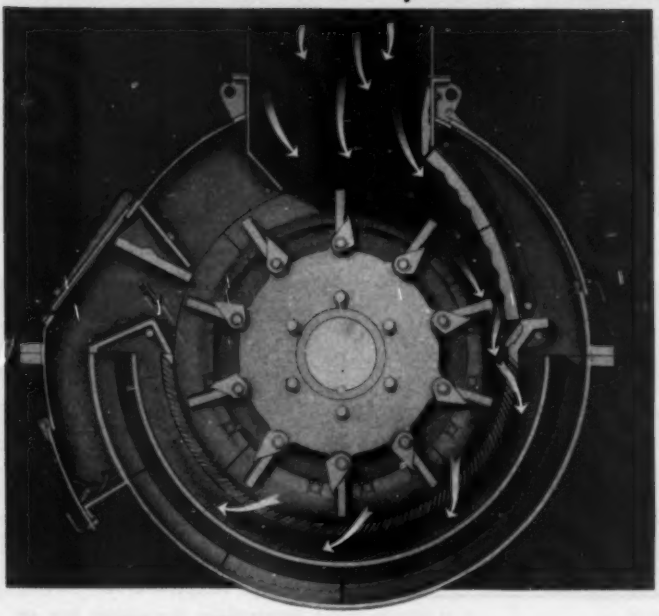
RILEY

STOKER CORPORATION, WORCESTER, MASS.

Boston · New York · Philadelphia · Washington · Buffalo · Pittsburgh · Cleveland · Detroit · Chicago
Cincinnati · Charlotte · Atlanta · New Orleans · St. Louis · Kansas City · St. Paul · Tulsa · Houston
Denver · Salt Lake City · Los Angeles · Portland · Seattle

BOILERS · PULVERIZERS · BURNERS · STOKERS · SUPERHEATERS · ECONOMIZERS

not affected by Increase in Moisture



This Crusher-Dryer Stage Does the Trick

Both field and laboratory tests have conclusively proven that moisture content of coal does not affect performance of Riley "50" Pulverizers and that capacity is not decreased with an increase in moisture provided primary air temperatures are adequate. Coals with free moisture up to 15%, which is about the free moisture limit that coal can retain, have been satisfactorily pulverized.

The ability of Riley "50" Pulverizers to handle such high moisture coals without capacity reduction is due to the performance of the crusher-dryer section of the Riley "50" Pulverizer. In this first stage, the free moisture is evaporated and the coal crushed to a fine granular state so that coal passing to final pulverizing stage is free of surface moisture.

Ask users of Riley "50" Pulverizers—they will tell you that moisture of coal means nothing to their Riley "50" Pulverizers.

All of these people have ordered Riley "50" Pulverizers within the past two years.

PUBLIC UTILITIES

Detroit Edison Co.
Iowa-Illinois Gas & Electric Co.
Monongahela Power Co.
Utah Power & Light Co.
Hartford Electric Light Co.
Public Service Co. of Colorado
Iowa Electric Light & Power Co.
Northern States Power Co.
The Potomac Edison Co.
Superior Water, Light & Power Co.
Western Colorado Power Co.
South Carolina Public Service Authority
Corn Belt Power Cooperative
Central Ohio Light & Power Co.

MUNICIPAL PLANTS

City of Richmond, Indiana
City of Holyoke, Mass.
City of Rochester, Minn.
City of Owensboro, Ky.
City of Austin, Minn.

INDUSTRIAL COMPANIES

Carbide & Carbon Chemical Co.
Goodyear Tire & Rubber Co.
Western Electric Co.
General Electric Co.
Hooker Electrochemical Co.
North American Aviation
The Ohio Oil Co.
National Supply Co.
Continental Can Co.
Monsanto Chemical Co.
St. Croix Paper Co.
Celanese Corp. of America
Owens-Corning Fiberglas Co.
Pittsburgh Plate Glass Co.
Lawless Bros. Paper Co.
U. S. Finishing Co.
Bell Aircraft Co.
Syracuse University
U. S. Steel Company
Riegel Textile Corp.
White Pine Copper Co.
Ciba States Ltd.
Great Lakes Naval Training Station
Boston Navy Yard
Ashland Oil & Refining Co.
Ruberoid Co.

ENGINEERED BY THE FOLLOWING CONSULTANTS

Stone & Webster Engineering Corp.
Ebasco Services
Sargent & Lundy
Ford, Bacon & Davis, Inc.
Chas. T. Main, Inc.
Sanderson & Porter
United Engineers & Constructors
Jackson & Moreland
Bechtel Corporation
Pioneer Service & Engineering Co.
Black & Veatch
Stanley Engineering Co.
Douglas M. McBean
Robson & Weese, Inc.
Francisco & Jacobs
Burns & McDonald
Kenneth R. Warrington
J. V. Edeskuty
Robert S. Curl & Associates
Interboro Company
Catalytic Construction Co.

A survey of your Power Plant by a consulting engineer will possibly show ways of making surprisingly large savings in your power costs

COMPLETE STEAM GENERATING UNITS

. . . it will pay you to visit modern Riley Installations before purchasing Boiler or Fuel Burning Equipment

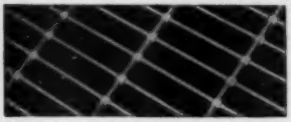
WATER-COOLED FURNACES • STEEL-CLAD INSULATED SETTINGS • AIR HEATERS

New equipment and developments

(Continued from page 14)

22—Grating incorporates round cross bars

Round steel cross bars are incorporated in an open welded grating produced by Klemp Metal Grating Corp. The round cross braces are said to provide greater tensile strength and a



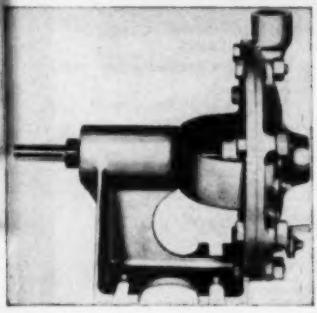
stronger weld. Increased non-slip characteristics are provided by a ridge between each bearing bar.

23—Belt dressing features pressurized can

Belt dressing for flat or V-belt drives is now available in a pressurized can, according to the manufacturer, A. W. Chesterton Co. It is claimed that the product, known as Spragrip, will prevent slippage of slack belts, thus lengthening bearing life.

24—Reversible pump can be easily installed

Installation in any position, simplified piping design and adaptability to any type of drive are advantages of the model CAY centrifugal pump, accord-



ing to the manufacturer, Gardner-Denver Co. It is said to operate with equal efficiency in either direction. A mechanical seal is used to eliminate stuffing box leakage. Designed primarily for circulating cooling water in such equipment as air compressors and diesel or gasoline engines, it is suitable for up to 67 gpm with heads to 50 ft.

25—Plastic conveyer belt offers many advantages

Many difficult conveyer problems can be solved by a conveyer belting made of Teflon coated glass fabrics, according to the distributor, Voss Belting & Specialty Co. Advantages of the plastic include resistance to chemicals and temperatures, as well as non-sticking properties and resistance to wear.

26—Wire connectors are made of phenolic material

Wire connectors made of phenolic material have been added to the Dutch Brand electrical products manufactured by Van Cleef Bros., Inc. The DB connectors, listed by Underwriters'

Laboratories, Inc., are said to provide resistance to shorts, grounding and vibration. Four sizes are available.

TO REQUEST ADDITIONAL FREE DATA

Insert " key" numbers on return post card found on page 131. Our Reader's Service Department will handle your request promptly

27—Fire extinguisher is easy to operate

Randolph Laboratories, Inc. has announced a portable 12 lb capacity carbon dioxide fire extinguisher. Thumb trigger release and a light weight nozzle are featured. Said to be designed

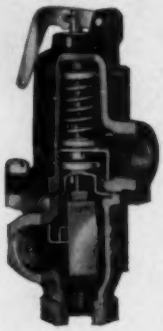
especially for the average employee, it is recommended to smother flammable liquid and electrical fires.

28—Solvents clean electric motors

Two products for cleaning and reactivating electric motors have been developed by Northwoods Manufacturing Chemists, Inc. The first, known as DMC, is applied with a commercial atomizer or ordinary sprayer. It is recommended for equipment where disassembling is difficult. The other, called EMC, is a dip solvent. In use, the motor is submerged and current is applied through the unit for 3 to 5 min. It is then dried with a blast of compressed air. This entire operation is said to require less than 15 min.

29—Relief valve combines two mechanisms

For use on hot water tanks and heaters, McDonnell & Miller, Inc. has developed the Series 202 temperature and pressure relief valve. The operating mechanism of a pressure relief unit has been combined with that of a temperature relief unit to form one unit. Standard valves are available with opening pressure settings of 75, 100 or 125 psi. The units are of the automatic reseating type. Temperature relief capacity is 725,000 Btu per hr for all units. Details of construction are described in a data sheet.



30—Paint withstands high temperatures

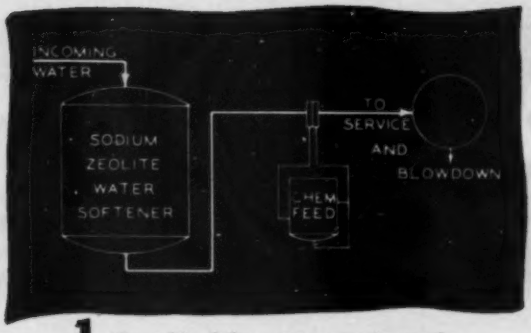
Copper flakes in a silicone base are incorporated in a gold colored paint, Heat-Rem XG-170 Gold, manufactured by Speco, Inc. The paint, which withstands temperatures to 1700 F, will air dry in approximately 30 min, and is said to fuse with the metal surface when heat is applied. Recommended applications include high pressure boilers, ovens, exhaust manifolds, heat lines, compressors and engine heads.

31—Lubricator automatically signals low oil level

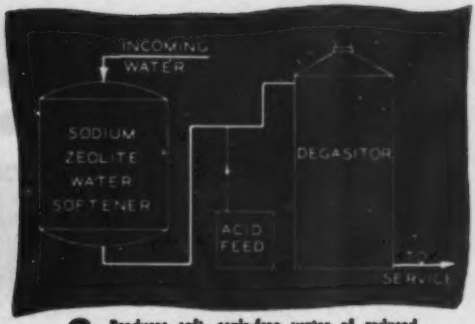
Lubricators with automatic low level warning signals have been developed by Alemite Div. of Stewart-Warner Corp. Models of the unit, known as

Oil-Mist, are available for signalling by light or horn, or for shutting off the machine. Reservoir capacities are 12 oz or 1 gal.

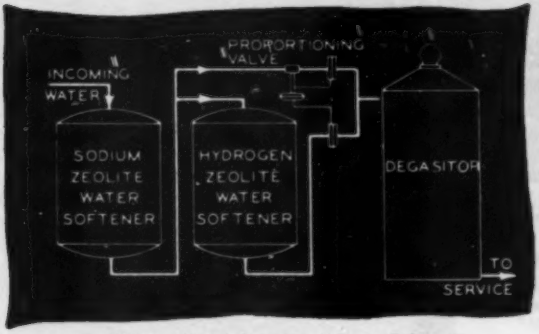
(Continued on page 27)



1 Gives soft, scale-free water — prevents corrosion.



2 Produces soft, scale-free water of reduced alkalinity.



3 Delivers soft, scale-free water. Reduces alkalinity to desired level and gives marked reduction in total dissolved solids.

4 Produces deionized water of highest known chemical purity. Removes CO_2, silica, and all ionizable solids.

Four ELGIN Ways . . .

to Control Dissolved Solids and Alkalinity of Boiler Feed and Process Water

With 43 years of experience in the design and manufacture of water conditioning equipment, Elgin is qualified to provide exactly the type of water conditioning system best suited to your specific needs.

This is well illustrated by the four typical ion exchange systems diagramed above which deliver water "tailored" to the specific requirements of any boiler plant or processing operation. It will pay you to study these diagrams one by one.

In many cases a zeolite water softener supplemented by chemical treatment (diagram 1) will deliver water of suitable quality for the purpose at low cost.

Where soft, scale-free water of reduced alkalinity is required, zeolite softening plus acid feed and degasification (diagram 2) is the economical answer for many water supplies.

Should a marked reduction in total dissolved solids also be desired, blended sodium and hydrogen zeolite softened water plus degasification (diagram 3) will best do the job.

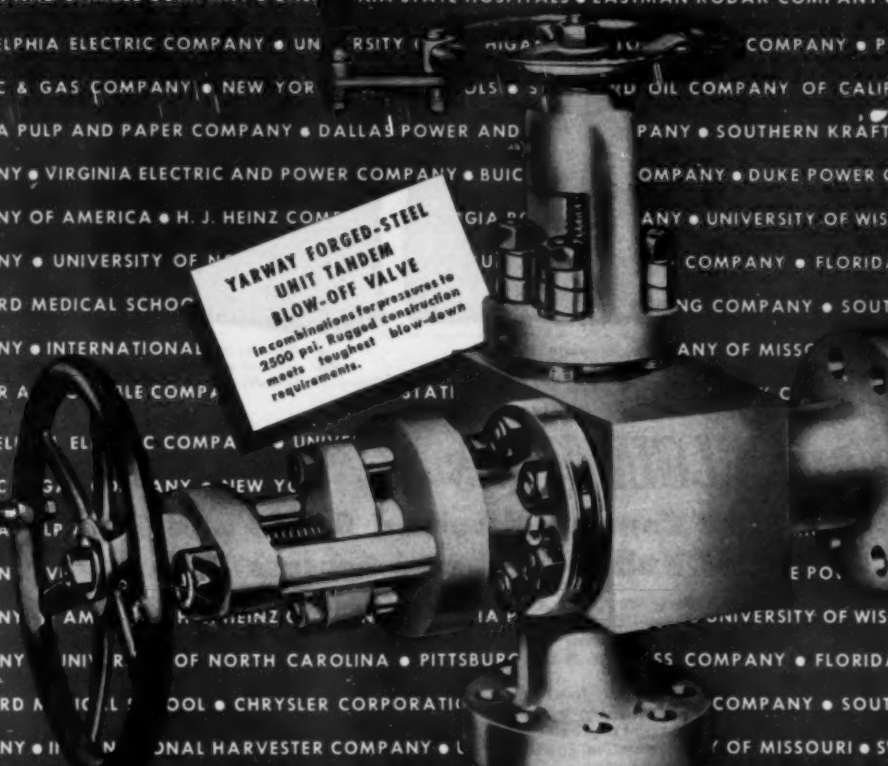
For the highest quality water known today, the Ultra-DeIonizer (diagram 4) is the ultimate in water conditioning. This remarkable single-tank unit which contains mixed anion and cation exchange resins, delivers chemically pure water, free of silica and CO_2 at an amazingly low cost.

Yes, these are typical examples of the broad scope of Elgin water conditioning. One of our engineers will be glad to study your conditions and lay out a "tailored" system which will best fit your need and budget — permanently solve your water problem. Write us today.

ELGIN
Economical
WATER CONDITIONING
FOR EVERY NEED

ELGIN SOFTENER CORPORATION
138 North Grove Avenue, Elgin, Illinois

A BLOW-


YARWAY FORGED-STEEL
UNIT TANDEM
BLOW-OFF VALVE
In combinations for pressures to 2500 psi. Rugged construction meets toughest blow-down requirements.

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OFF VALVE

When buying blow-off valves, weigh the significance of these two facts:

More than 15,000 boiler plants in the United States and other countries are equipped with Yarway Blow-Off Valves... Some of them for nearly 40 years. *Among high pressure plants, 4 out of every 5 in the United States are Yarway-equipped.*

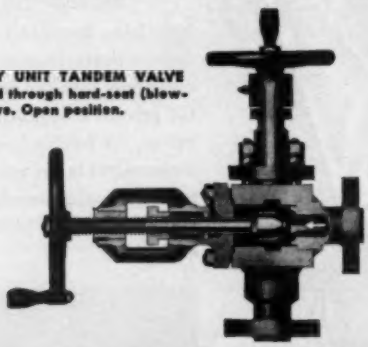
Design, metallurgy, workmanship and service are the reasons. It was Yarway that brought out the famous Seatless Valve, teamed it with a stellited hard-seat valve in a common forged-steel body to make the popular Unit Tandem. Yarway has also made available metallurgical improvements to withstand the chemical reactions of acid wash as well as the mechanical wear of boiler blow-down.

Yarway continues to pioneer and improve blow-off valves and blow-off valve service for both high and low pressure applications.

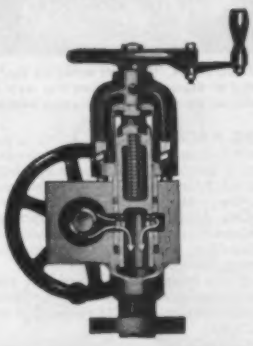
On new boilers, replacements or modernization, make sure you specify Yarway Blow-Off Valves. Any boiler manufacturer will supply them on your specification.

Bulletin B-424 gives you the full story on pressures to 400 psi. Bulletin B-433 for higher pressures. Both are free. Write...

YARNALL-WARING COMPANY, 109 Mermaid Ave., Philadelphia 18, Pa.



YARWAY UNIT TANDEM VALVE sectioned through hard-seat (blowing) valve. Open position.



YARWAY UNIT TANDEM VALVE sectioned through seatless (sealing) valve. Open position.

ALOYCO valves unaffected by corrosive processing solutions at Industrial Rayon Corp.

THE CORROSIVE: Sulphuric acid spinning bath in corrosive concentration range.

THE APPLICATION: Handling solutions for continuous rayon processing.

THE PLACE: Industrial Rayon Corp., Painesville, Ohio, plant.

THE VALVES: 400 ALOYCO 20 No. 111-A gate valves, Teflon-packed.

THE RESULTS: ALOYCO valves have operated for 3¼ years without maintenance . . . an outstanding record unmatched by any other valve in this service.

ALOYCO 20 No. 111-A gate valves are used by Industrial Rayon Corp. because they resist the corrosive action of rayon processing solutions.

THE BACKGROUND: ALOYCO concentrates on valves for such severe corrosive service. Our foundry practices, our machines and our tools are designed for the production of high alloys alone.

Our *Aloyco Corrosion Clinic* specializes on problems of corrosion, contamination, discoloration, high and low temperature service.

If you have such problems in your plant, perhaps you too can profitably standardize on ALOYCO valves. Just ask ALOYCO.

ALLOY STEEL PRODUCTS CO., INC.
1203 West Elizabeth Avenue, Linden, N. J.

Longer Lasting
ALOYCO VALVES
1st in Corrosive Service

Lasts longer in corrosive service

ALOYCO "Teflon" seated valves have been specifically engineered to correct characteristic weaknesses commonly found in small valves used in the process industries. Like all ALOYCO valves, the trouble-free performance of these valves is the result of extensive metallurgical research and engineering and production of high alloy valves exclusively.

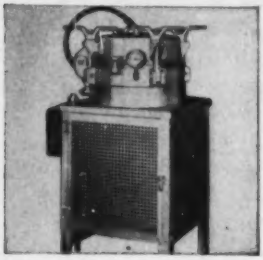
ALOYCO No. 45 "Teflon" Seated Valve has three outstanding features: (1) molded renewable "Teflon" seats, (2) outside stem threads, (3) union bonnet construction.

New equipment and developments

(Continued from page 22)

32—Oil reclaiming unit is self-contained

Hilco oil reclaimers, developed by The Hilliard Corp., can be direct connected to turbine reservoirs or oil tanks for continuous operation, or to dirty and clean oil tanks for batch operation. The units are supplied in a self-contained package including ac-



cessories such as pumps, motor, heater and heat exchanger. Oil is said to be purified in a single pass through the unit. A bulletin describes operation.

33—Grease fitting stops leak-back

Construction of a giant buttonhead grease fitting developed by Universal Lubricating Systems, Inc., prevents leak-backs and provides maximum grease flow. The unit, which employs one-piece construction, is for use on all heavy industrial machinery. Design details are described in a catalog.

34—Diesel engine governor has many advantages

Dale Hydraulic Controls, Inc. has announced development of a hydraulic governor for universal application on

all types of diesel engines. Simple adjustments are used to adapt the unit to the particular requirements of an engine. The unit adjusts automatically to temperature changes. Improved control of recovery time and greater sensitivity also are claimed.

35—Sprinkler features increased sensitivity

Utilization of a solid organic chemical as the fusible element in the Save-all automatic sprinkler provides in-

creased sensitivity, according to Globe Automatic Sprinkler Co., Inc. Compounds with different fusing temperatures are employed to provide various ratings for this central strut type unit. Temperature ratings offered include 135, 160, 212, 280, 340 and 415 degrees.

TO REQUEST ADDITIONAL FREE DATA

Insert "key" numbers on return post card found on page 131. Our Reader's Service Department will handle your request promptly

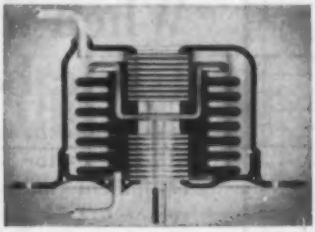
36—Burner is efficient over wide range

Refinements incorporated in the Voriflow burner manufactured by Orr & Sembower, Inc., and used in conjunction with their package unit boilers, are said to increase efficiency. The burner is an air atomizing type. Ac-

cording to the manufacturer, an excellent flame pattern, clean combustion and full efficiency can be obtained over loads of 30 to 100 per cent, firing light through No. 6 Bunker C oils.

37—Bellows assembly provides single unit control

Maintenance of absolute pressure by means of a single unit control is provided by a bellows assembly developed by Clifford Manufacturing Co. It is recommended for processes where pressures within a closed system must be automatically equalized or where absolute rather than gage pressure must be maintained. Motion produced in the main bellows by a pressure differential also can be used to



actuate switches or valves to accomplish such work as moving levers, cams and controls.

38—Hose material resists acids

Rubber hose, developed by Hewitt Rubber Div. of Hewitt-Robins, Inc., is said to offer increased resistance of concentrated organic and inorganic acids. Tests have indicated resistance to maximum concentrations of 100 per cent for acetic, hydrochloric and hydrofluoric, 75 per cent for nitric and 98 per cent for sulfuric. It is also suitable for chlorine and saturated chlorine water.

39—Plastic valves resist corrosion

Valve bodies molded of chemical resistant plastics are incorporated in general purpose diaphragm valves devel-

oped by American Hard Rubber Co. The diaphragm may be rubber, neoprene or polyethylene, as required. Applications include handling food products as well as many corrosive chemicals. Sizes are from ½ to 2 in., threaded for standard pipe threads. Working pressure is 50 psi at 77 F.

40—Solvent provides fast degreasing

Rapid cleaning of electrical and engine accessories is possible with Flo, a metal degreaser, according to the

(Continued on page 34)

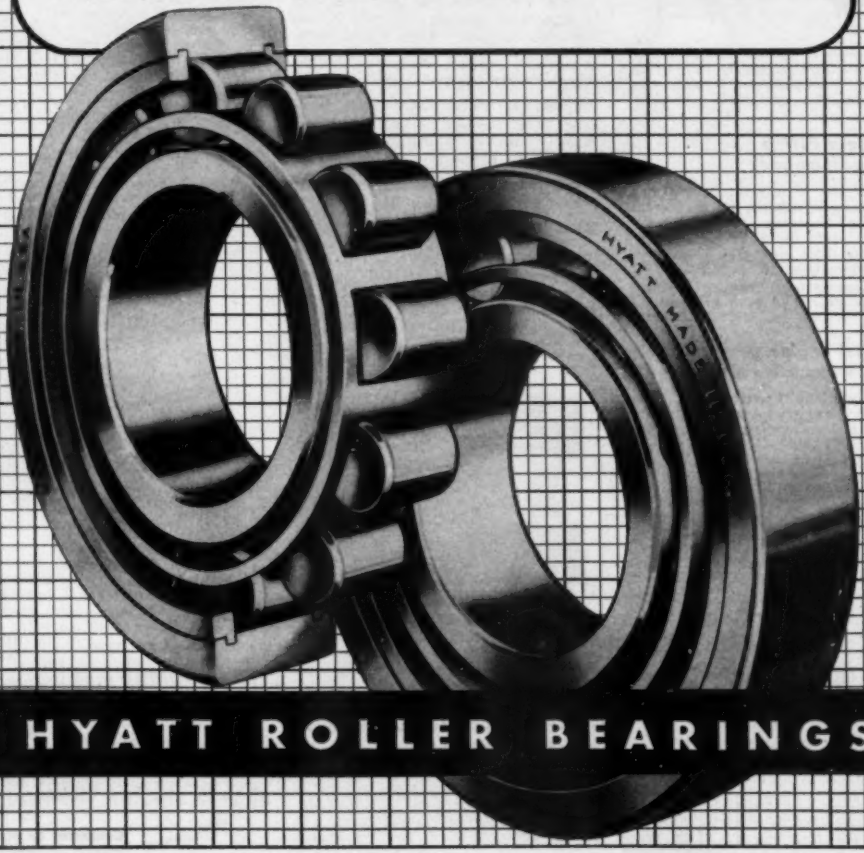
When the specs say "HYATT"— the bearings are the best

Just because the bearings are out of sight in the machinery and equipment you buy, there is no reason to take them for granted.

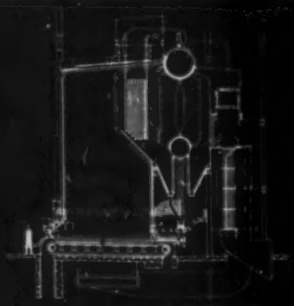
You want real assurance that you are getting the best bearings for each specific application.

The design—quality—capacity — precision — past experience of Hyatt Roller Bearings—all add up to perfect performance for you. Hyatts give you that smoothest-operating — care-free — wear-free service you have the right to expect for your money.

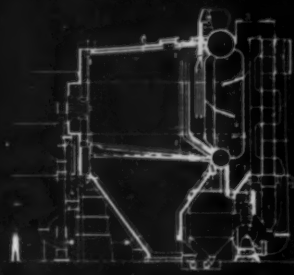
So, before you buy, look at the bearing specifications—if they include Hyatts, you can depend on these better bearings to be right in every way, just as they have been for the past fifty-nine years. Hyatt Bearings Division, General Motors Corporation, Harrison, New Jersey.



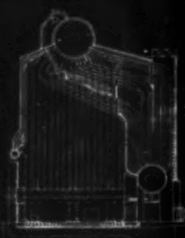
HYATT ROLLER BEARINGS



VU-40 BOILER installed in a large Southern plant. This unit is fired by coal, using C-E Spreader Stokers (continuous discharge type). Capacity of this boiler is 150,000 lb of steam per hr at a pressure of 900 psi and a temperature of 808 F.



VU-50 BOILER installed in Midwestern plant. This boiler is fired with pulverized coal using C-E Raymond Bowl Mills. The capacity is 65,000 lb of steam per hr. Steam pressure is 400 psi — steam temperature is 600 F.



VU-10 BOILER fired with oil. Installed in an Eastern plant, the boiler's capacity is 15,000 lb of steam per hr at 250 psi and 480 F. VU-10 capacities range from 10,000 to 60,000 lb of steam per hr. They may also be fired by spreader, underfeed or chain grate stokers.

Industries follow the leaders to VU

In industry after industry, you'll find leading companies are setting the pace for efficient, reliable steam production with C-E Vertical-Unit Boilers.

The Chemical Industry is a typical example. For VU Boilers have been purchased by most of the major manufacturers in this industry, including such nationally-known leaders as those shown in the list below.

Furthermore, chemical manufacturers, both large and small, have *proved* their satisfaction with Vertical-Unit Boilers by buying them again and again. In 1951, for example, more than 60 per cent of the VU capacity ordered by chemical companies represented repeat order business. One leading manufacturer, in fact, has purchased twenty-seven units during the past twelve years — *eleven of them in 1951!*

You can profit from the experience of the Chemical Industry — as from any industry where steam for power or process is of major importance. If you use steam, investigate the lower steam costs you can get through the advanced design . . . sound construction . . . proved reliability of VU Boilers. They are available in capacities to fit your needs — from 10,000 to 350,000 pounds of steam per hour.

Typical List of Chemical Companies that have purchased VU Boilers for one or more plants

Air Reduction Co., Inc.
Allied Chemical & Dye Corp.
Atlas Powder Co.
Carbide & Carbon Chemical Corp.
Colgate-Palmolive-Peet Co.
Diamond Alkali Co.
E. I. du Pont de Nemours & Co., Inc.
B. F. Goodrich Chemical Co.
Hercules Powder Co.
Merck & Co., Inc.
National Distillers Chemical Co.
Pennsylvania Salt Mfg. Co.
Pittsburgh Coke & Chemical Co.
Charles Pfizer & Co.
Shell Chemical Co.
U. S. Industrial Chemicals Co.

C-E

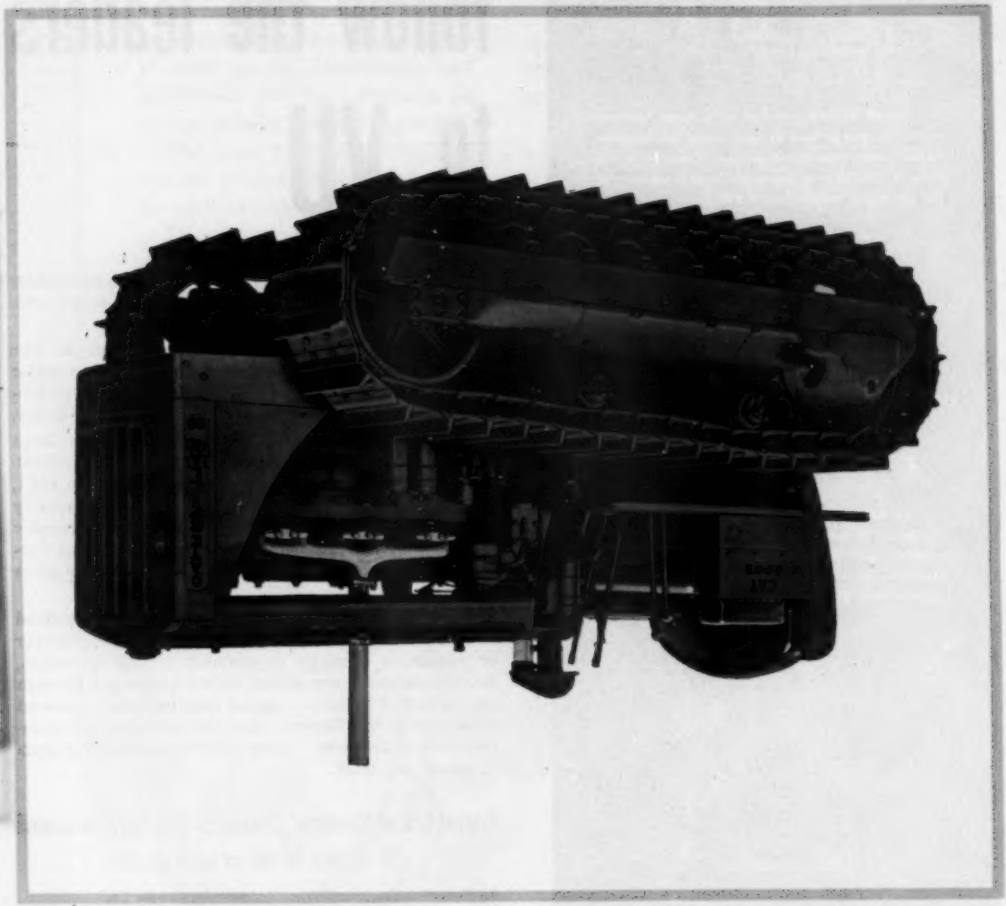
COMBUSTION ENGINEERING—SUPERHEATER, INC.

200 Madison Avenue • New York 16, N. Y. B-5834

ALL TYPES OF BOILERS, FURNACES, PULVERIZED FUEL SYSTEMS AND STOKERS; ALSO SUPERHEATERS, ECONOMIZERS AND AIR HEATERS

WE TURNED A TRAC

to make the feeder that



WHEN CATERPILLAR TRACTOR CO., Peoria, Ill., recently installed two* Perfect Spread Stokers at its Joliet plant it had a very special reason for confidence. The same high traction principle that has been basic to Caterpillar's own success and leadership is employed in the AE conveyor feeder . . . and this principle assures 100% uniformity of spread; *absolutely prevents clogging on wet coal!*

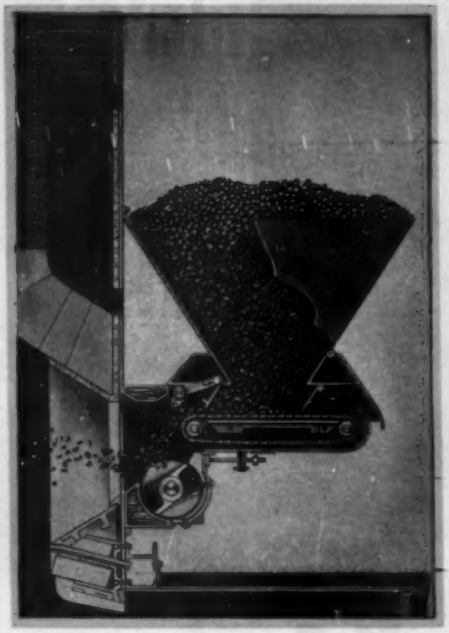
You can get Perfect Spread Stokers in a wide choice of sizes, capacities and grate types . . . but when it comes to the feeder there is only *one* choice. Every Perfect Spread Stoker is equipped with American Engineering's exclusive conveyor feeder . . . the feeder whose superiority is universally recognized and which assures true, *continuous* feeding whether operating at only 50 lbs. of coal per hour or at top capacity.

For most steam per fuel dollar, mail coupon on next page . . . today!

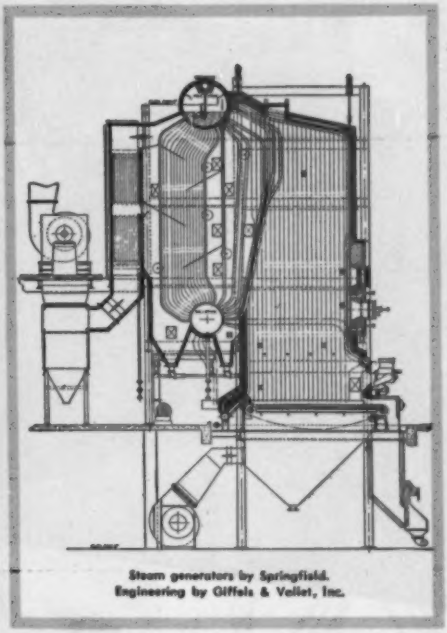
***A THIRD UNIT HAS BEEN ORDERED AND IS NOW BEING ENGINEERED.**

TOR UPSIDE DOWN

won't clog on wet coal



On Perfect Spread Stoker's traveling conveyor feeder a special mechanism drives feeder through a widely adjustable speed range – smoothly and continuously . . . Feeder unit protected against furnace temperatures by water and air cooling around furnace opening and rotor bearings . . . Special high-capacity spiral overthrow rotor distributes coal evenly over the entire grate surface . . . AE reinjection system features visible feed ejector hoppers, ejectors and nozzles of alloy iron. Complete reinjection unit serves every cinder drain point.



Steam generators by Springfield.
Engineering by Giffels & Vallet, Inc.

Cross section drawing showing arrangement of boiler components and some of the principal auxiliaries of the Perfect Spread Stoker installations at the Joliet plant of Caterpillar Tractor Co. The two boilers are designed to operate at 80,000 lbs. per hour continuously, with a peak rating of 90,000 lbs. per hour for a two-hour period. Stokers are 12' wide by 14' 3" long, center to center sprockets. Each stoker has three feeders; 171 sq. ft. total grate area with 150 sq. ft. active area; and each is operated by a 1½ hp. 1800 r.p.m. electric motor.

AMERICAN ENGINEERING
COMPANY
PHILADELPHIA 25, PENNA.

All Products are: Taylor and Perfect Spread Stokers, Marine Deck Auxiliaries, Hele-Shaw and Hydramite Fluid Power, Lo-Hed Hoists, Lo-Hed Car Pullers.

American Engineering Company
2406 Aramingo Ave., Philadelphia, Penna.

Gentlemen: – We are interested in getting top efficiency from both low and high ash coals. Please send us full information about Perfect Spread Stokers.

☐ Also send us complete story of *Caterpillar Installation.*

Name..... Title.....

Company .....

Address .....

City ..... Zone..... State.....

with a

Class Y Compressor

— and only a simple foundation is needed for this exceedingly compact unit.

Shipped intact as a "package" requiring only external connections, the Class Y is easy and inexpensive to install, and may readily be moved, intact, to another location if desired.

Yet it is built for continuous, heavy-duty service, with CP features that assure high efficiency and low maintenance . . . large area Simplate valves . . . multi-step capacity regulation . . . effective inter-cooling . . . precision bearings . . . force-feed lubrication.

In sizes from 75 hp. to 250 hp., 500 cfm to 1663 cfm; with direct-connected, flange-mounted synchronous or squirrel cage motor. Also available with belted and coupled motors.

Write for Bulletin 766

CP Fiftieth ANNIVERSARY

CHICAGO PNEUMATIC TOOL COMPANY

General Offices: 8 East 44th Street, New York 17, N. Y.

PNEUMATIC TOOLS • AIR COMPRESSORS • ELECTRIC TOOLS • DIESEL ENGINES
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COPPUS "BLUE RIBBON" VENTILATORS

Used in wide variety of applications throughout industry

Improve workers' safety . . . health . . . comfort . . . efficiency

VANO DESIGN "A" VENTILATOR is used here during repairs to a chemical still. This type ventilator is used to ventilate tanks, tank cars, drums, vats, underground cable manholes, pipe galleries, airplane wing compartments, fuselages and other confined places. Uses 8" diameter flexible canvas tubing ("Ventube").

VANO DESIGN "B" VENTILATOR here discharges welding fumes from double-bottom compartment in naval vessel under construction. Large volume of air handled quickly expels fumes and results in good ventilation. Vano Design "B" can pass through opening only 14" in diameter. Uses 8" diameter flexible canvas tubing ("Ventube").

VANO DESIGN "C" VENTILATOR here withdraws fumes from a reactor kettle. This ventilator can be furnished with 8" suction inlet for 8" non-collapsible suction tubing — or multiple inlet nozzles for 5", 4", and 3" suction hose. The discharge may be connected to 8" "Ventube." Capacities furnished on request.

NO. 2 AEROPLANE HEAT KILLER here directs cool, fresh air on worker in drop forge plant. Heat killers restore workers' efficiency by providing extra ventilation in the hot months, or on any job where workers are continually or periodically required to work in excessive heat. Available in two types, three sizes in each.

VENTAIR DESIGN TE-4 VENTILATOR Gasoline Engine Driven, here delivers air into underground manhole. These ventilators provide fresh air to men in confined places, promoting safety, comfort, and increasing efficiency. Ideal where no electric current is available. Delivers 1700 CFM of fresh air. Uses 8" diameter flexible canvas tubing ("Ventube").

PORTAIR NO. 4 BLOWER EXHAUSTER exhausts fumes resulting from soldering, welding, tank coating, is also used in ventilating small tanks. It is designed to permit attachment of 4" flexible metal hose. Capacity: 425 CFM free air.

ATTACH THIS COUPON TO YOUR COMPANY LETTERHEAD

COPPUS ENGINEERING CORPORATION, 190 PARK AVENUE, WORCESTER 2, MASS. Sales offices in Thomas' Register. Other "Blue Ribbon" Products in Chemical Engineering Catalog, Refinery Catalog, Best's Safety Directory and Mining Catalogs.

Please send me information on supplying fresh air to men working:

- ☐ in tanks, tank cars, drums, etc.
- ☐ in underground cable manholes
- ☐ in aeroplane fuselages, wings, etc.
- ☐ on coke ovens
- ☐ on steam-heated rubber processes
- ☐ on boiler repair jobs

COOLING:

- ☐ motors, generators, switchboards
- ☐ wires and sheets
- ☐ general man cooling
- ☐ around cracking stills
- ☐ exhausting welding fumes
- ☐ stirring up stagnant air wherever men are working or material is drying
- ☐ drying of walls, sheets, etc., after treated with coating material

Name .....

Company .....

Address .....

City .....Zone....State.....

Write here any special ventilating problem you may have { _____ _____

New equipment and developments

(Continued from page 27)

manufacturer, Curran Corp. It is a quick drying solvent for recirculation degreasing machines—said to be noncorrosive, dries without leaving film or sticky residue and does not tend to defat human skin.

41—Heat exchanger tee is for process lines

Heat is exchanged between coolants and process fluids by the Swagelok heat exchanger tee developed by Crawford Fitting Co. The unit, designed for steam jacketing or temperature con-

trol of process lines, is available in sizes up to 1 in. OD for the jacketing tube. Various materials of construction are available.

42—Safety valve helps eliminate fire hazard

For use with natural and manufactured gas, an automatic cut-off valve developed by Kelly Safety Device Co. is said to prevent discharge of gas from a melted meter in the event of fire. The unit is placed in the supply line in front of the meter. A fusible link, made of Geon 404 plastic, distorts at approximately 165 F and causes a tension spring to close the valve.

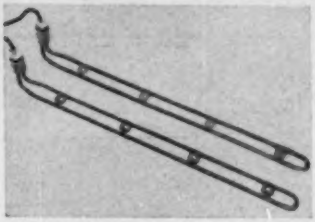
43—Activated carbon filter is for heavy duty

W. B. Connor Engineering Corp. has announced the Dorex heavy duty activated carbon air recovery filter cell. Designated T-42, it is recommended for odor removal applications other than in comfort conditioning systems, such as recovery of recirculated air in

industrial plants and purification of contaminated exhaust and intake air. The unit is rated at 700 cfm. Construction is described in a bulletin.

44—Heater is designed for welding operations

Edwin L. Wiegand Co. has designed an electric tubular heater to be used in conjunction with welding steel pipe



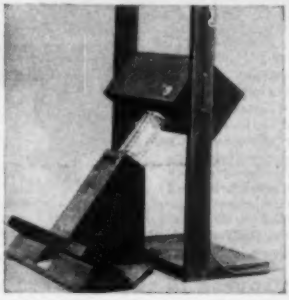
and plate. The unit reduces temperature differential between weld area and adjacent metal, thereby eliminating stresses that frequently cause failure of welded parts. The Chromalox elements have a triangular cross section to permit one flat side to contact the work for efficient heat transfer. The units also provide controlled heating and cooling.

TO REQUEST ADDITIONAL FREE DATA

Insert "key" numbers on return post card found on page 131. Our Reader's Service Department will handle your request promptly

45—Lamp accessory is for water analyzer

Uniform daylight conditions are provided by a lamp accessory designed for the Taylor water analyzer. The manu-



facturer, W. A. Taylor, states it is well suited for use when water analyses must be made at night or in poorly lighted areas. It can be used with either long or short analyzer tubes. Operation is with any type of 110 v current.

46—Fire extinguisher horn grounds static

Static electricity produced when a carbon dioxide fire extinguisher is discharged, is grounded by a built-in feature of the Anti-Statik horn, manufactured by American-LaFrance-Foamite Corp. This feature is said to eliminate the possibility of shock to the operator. Horns are available for units of over 5 lb capacity. The company states smaller units do not build up a sufficient charge to present a problem.

47—Mat switches are ready to operate

Extended area electrical switches in the form of thin mats are now produced complete with accessories and ready to plug in, according to the manufacturer, The Recora Co. Known as Switchmat, they are available in any

size or shape from 2 x 2 to 36 x 144 in. In operation, a predetermined pressure applied to any part of the mat closes the circuit, while release of pressure opens it. Many applications are suggested in a 2-page data sheet.

48—Plastic material seals vacuum lines

Vacuum line leakage is said to be reduced by a plastic gasket material manufactured by Flexrock Co. A 1/64 in. film is applied to gaskets or flange faces. Additional sealing is possible by applying to outside flange surfaces. The product does not harden, so that dismantling is simplified. Two types are available—one for air, steam, water or mild chemicals and the other for such liquids as oil, gasoline or solvents.

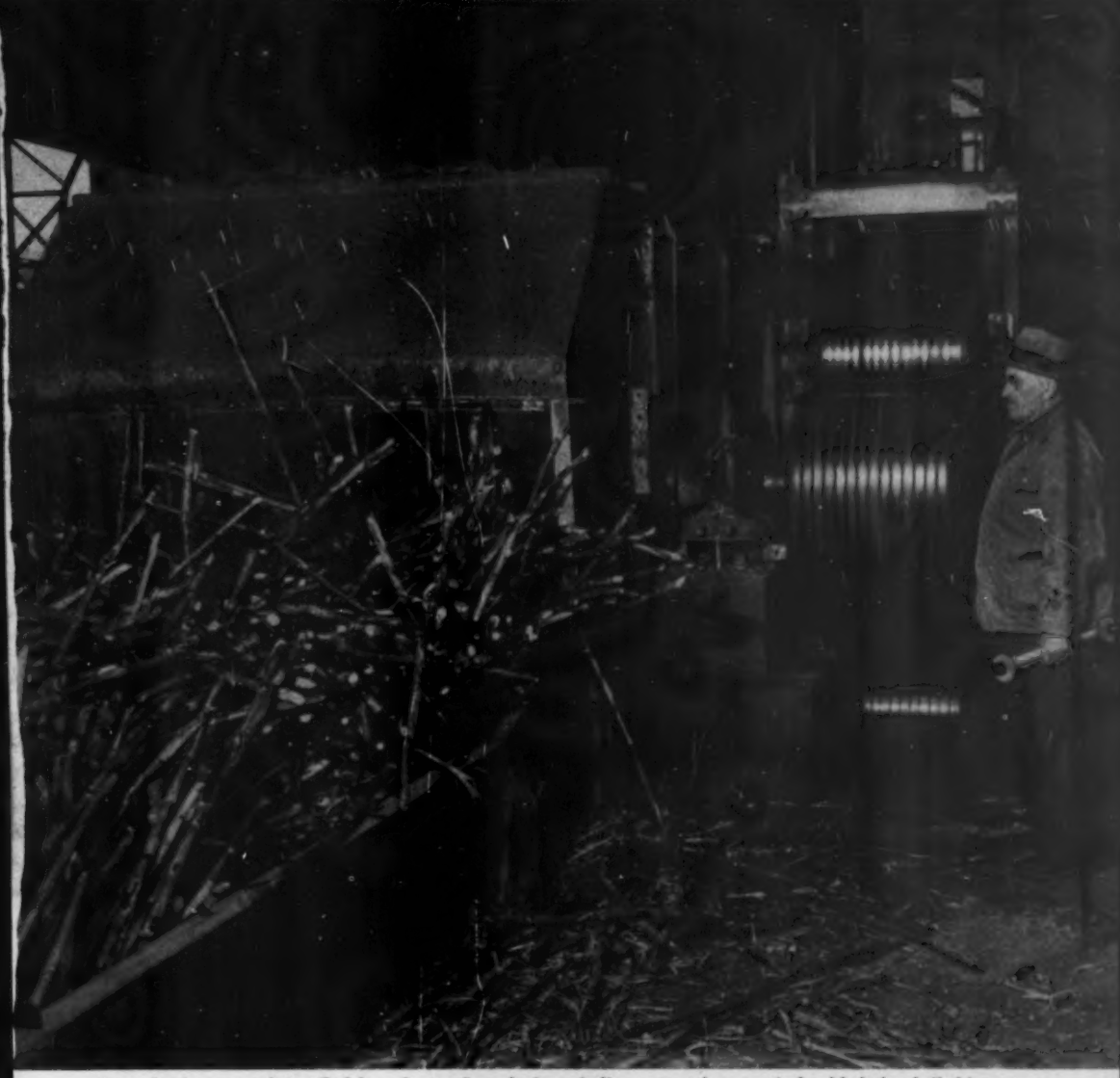
49—Hook-on instrument features higher ranges

Higher voltage and current ranges and a new pointer-stop mechanism have been incorporated in a hook-on volt-ammeter, type AK-1A, manufactured by the Meter and Instrument Dept. of General Electric Co. The unit

measures alternating current on five scale ranges: 0-7.5/30/75/300/750 amp. It can be used on insulated or noninsulated conductors. Three a-c voltage scales are 0-150/300/750 v. The pointer-stop mechanism permits quick determination of motor starting current peaks.

—End

B.F.Goodrich GROMMET BELTS AT WORK



Every day is sweetest day at Godchaux Sugars, Inc., during grinding season when cane is shredded, then boiled into sugar.

Raising cane— for candy makers

After sugar cane is harvested, that shredding machine has to work 24 hours a day, 7 days a week, or a lot of cane can spoil. Old-fashioned belts, originally used to drive the machine, couldn't stand the high speed and sudden jerks as carloads of cane are dumped into the cutting knives. They averaged only two years' use. To find out how this problem was solved, see the following pages.

Raising Cane (continued)

Grommet V belts are so much stronger, knives on the shredding machine can now chew up 40 extra tons of cane each hour.

The problem described on the preceding page was solved when B. F. Goodrich V belts were put on the drive. They lasted nine years. Now B. F. Goodrich grommet V belts are being used—and the sugar company finds they are so much stronger that the knives can cut 100 tons an hour instead of 60 as they used to do. The grommet belt is a typical B. F. Goodrich improvement—an improvement that saves money, does jobs better for industries of all kinds.

20 to 50% Longer Life

Patented grommet V belts by B. F. Goodrich represent the only basic improvement since invention of the V

belt. Belts last 20 to 50% longer, depending on service. (The more severe the service the greater the increase over ordinary belts.)

What is a grommet?

A grommet is like a giant cable except that it's endless—a cord loop built up by winding heavy cord on itself. There is no overlapping cord *section* as in all ordinary belts. Most belt failures occur in these sections where cords overlap!

All Cords Put to Work

Each grommet and every part of a grommet carries its share of the load. In ordinary belts under high tension the center cords "dish" because tension is greater near the driving faces. Dished cords are doing less work, not pulling their share. Grommet V belts have no center cords, there is no dishing—therefore much more strength in proportion to cord volume.

Better Grip, Less Slip

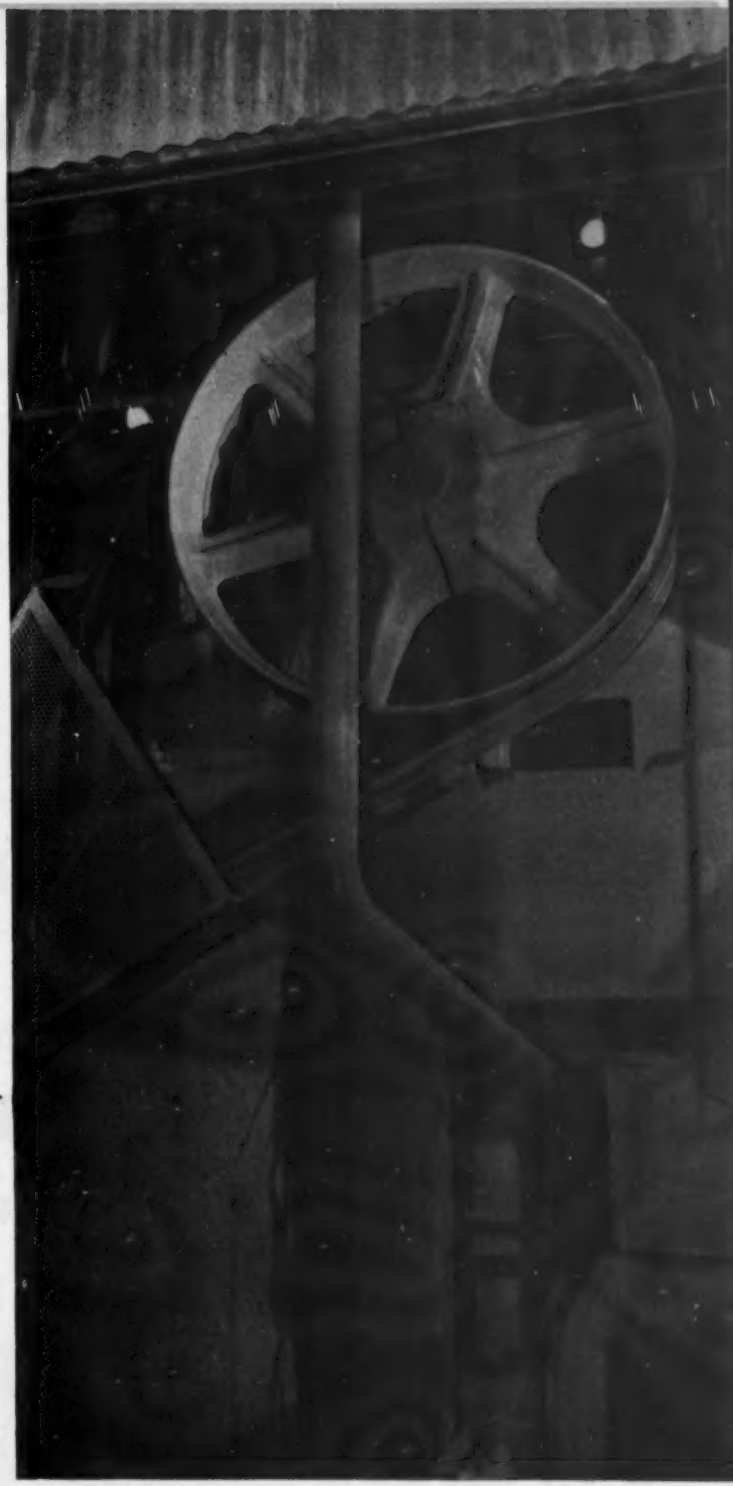
Grommet V belts have more rubber in relation to belt size. Without any stiff overlap, they're more flexible, grip pulleys better. Size for size, grommet belts give ⅓ more gripping power, pull heavier loads with a higher safety factor. Because there is less slip there is also less surface wear.

They Cost No More

You save belt costs because belts last longer, save production costs because machines keep running with fewer interruptions, save maintenance costs because they need less attention, yet cost not one cent more than others. Grommet belts are made in C, D and E sections. They are patented by B. F. Goodrich. No other V belt is a grommet belt (U. S. Patent No. 2,233,294).

Shock treatment

The jolting action of this rock crusher puts terrific shock and strain on the V belts. In addition to running 20 hours a day, seven days, the belts that drive the crusher are exposed to abrasive rock dust. Engineers knew no ordinary belt could handle the job, so grommet V belts, developed by B. F. Goodrich to give belt users more for their money, were installed. Grommet belts are not only operating the crusher more efficiently and cutting maintenance costs, but they are also giving long life for this type of service—eight months when the picture was taken—and are still going strong.



Treatment for shock was success when grommet V belts prescribed.

B.F.Goodrich GROMMET BELTS AT WORK

Rude awakening

Each morning these belts take a beating when this fully-loaded, brick-making machine is first started. The shock, combined with the heavy pulling load and high speed, caused the first set of V belts used on this drive to fail in only six months. Something exceptional was needed, so B. F. Goodrich grommet V belts were installed. That was over four years ago, and they're still in use. In fact, the company superintendent says it looks as though this original set of grommet V belts will operate another ten years.

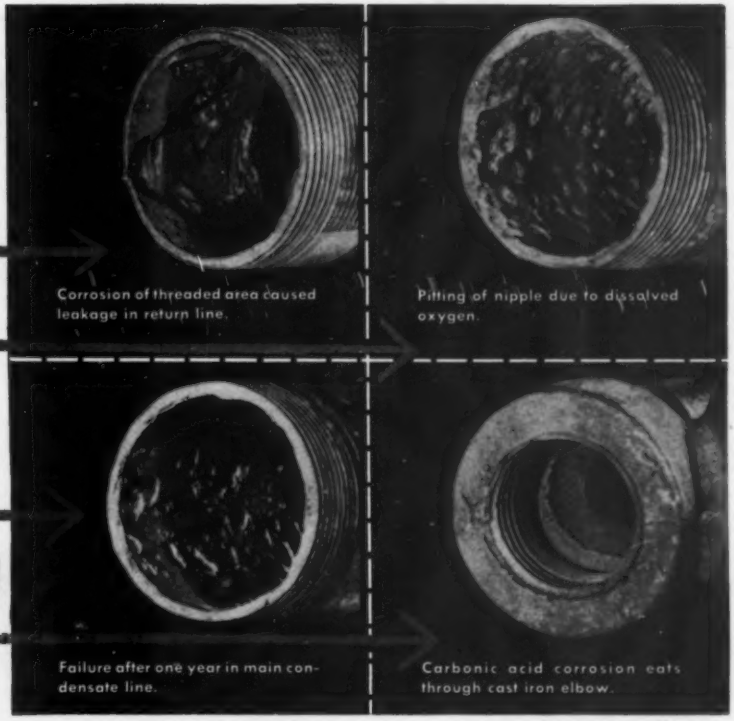
Belts whirl, clay is mixed and out of that machine come 16 million bricks each year.

These typical examples (see preceding pages) tell you why B. F. Goodrich grommet belts are superior to ordinary V belts — prove they last 20 to 50% longer—yet cost no more.

Grommet V Belts BY
B.F.Goodrich
FIRST IN RUBBER

The B. F. Goodrich Company, Industrial Products Division, Akron, Ohio

victims of Return Line Corrosion



Corrosion of threaded area caused leakage in return line.

Pitting of nipple due to dissolved oxygen.

Failure after one year in main condensate line.

Carbonic acid corrosion eats through cast iron elbow.

Dearborn Formula 702 will prevent Corrosion caused by low pH values

Excessively low pH values of water—caused by dissolved carbon dioxide—result in corrosion that destroys return line sections such as these.

The destruction of such valuable parts is easily and economically prevented with Dearborn Formula 702. Introduced directly into the boiler feed water, Formula 702 forms a continuous amine-type film on the return lines to effectively coat the lines against corrosion. In addition, Formula 702 will automatically repair any surface where the film has been broken by loosened rust scale, and also improve heat transfer in the line, thereby reducing the cost of steam production.

Your Dearborn Engineer will gladly demonstrate how you can reduce the cost of maintenance and avoid shutdowns with Dearborn Formula 702. Why not call him today?

DEARBORN CHEMICAL COMPANY

Merchandise Mart Plaza • Chicago 54, Illinois

BASIC PATENTS

Dearborn holds the basic patents (U.S.Pat. 2400543) for the use of filming amines for treating water.

YOU'LL WANT A COPY OF THIS BULLETIN Bulletin 5013, which outlines the causes of return line corrosion and the method of cure with Formula 702, will be sent on request.

Dearborn Chemical Company Dept. INP
Merchandise Mart Plaza
Chicago 54, Ill.

☐ Send a copy of Bulletin 5013
☐ Have a Dearborn Engineer call

Name.....

Position.....

Company.....

Address.....

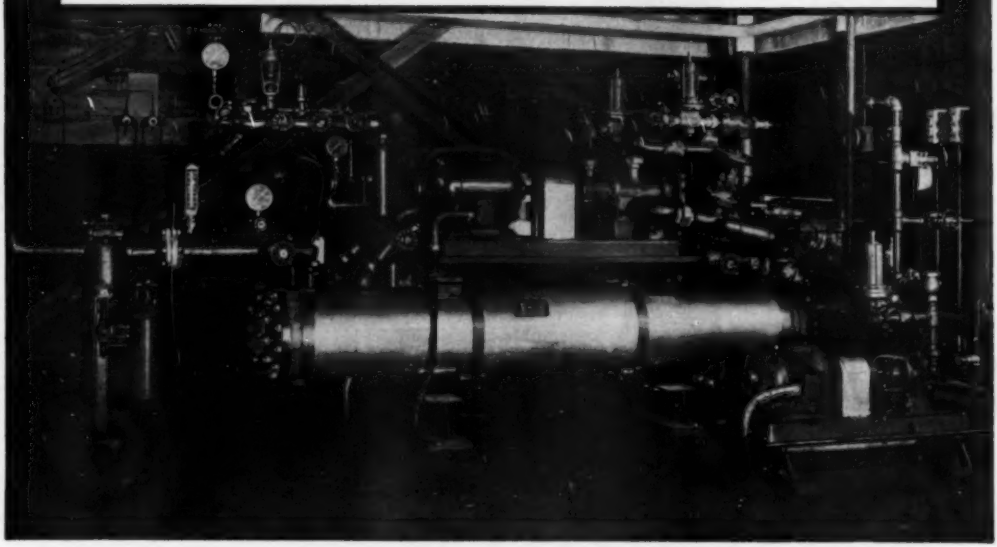
City.....*Zone*.....*State*.....

Dearborn

TRADE MARK REGISTERED

THE LEADER IN WATER TREATMENT AND RUST PREVENTIVES

2 separate ENCO Fuel Oil Units Meet Plant Needs



Here is a typical Enco two-unit installation which handles fuel oil pumping and heating requirements in the plant of a building materials manufacturer.

Fuel Oil Pumping and Heating Unit, built with two pumps and two heaters, is designed for continuous plant load service. Capacity is 11 gpm Bunker C fuel oil with one pump or one heater at 300 psig pressure with a temperature rise from 90F to 230F.

Light Oil Pumping Unit for cold start-up service. Capacity is 3 gpm #2 oil at 300 psig pressure.

Enco pump sets are designed to give you easier control and longer maintenance-free operation. They are simple and economical to install. All you need do is to connect to station piping and run. Before shipping, every Enco Fuel Oil Pumping and Heating Unit is completely tested under high pressures. For complete details on wide-range line, write for Bulletin O B-37.

Only ENCO offers all ten plus features

1. Completely Automatic Operation is assured by automatic temperature and pressure regulation valves.

2. Coordinated Design Saves Space. All equipment essential to the preparation of fuel oil for combustion is contained in one compact unit.

3. Individually Designed to meet the specific needs of the particular power plant in accordance with its exact operating requirements.

4. All Parts Visible and Accessible for easy operation, maintenance and repair.

5. Pumps and Heaters are interconnected to provide maximum flexibility of operation.

6. Safety Valves protect individual parts where required.

7. Easier Maintenance — Less Service-Time for Cleaning because straight tube, multi-pass heaters with removable heads are used.

8. Pumps Operate at Moderate Speed. Heaters designed to give the correct viscosity and velocity without fouling.

9. Smoother Flow of Clean Fuel to Furnace. Air chamber for each piston pump prevents pulsations—pressure regulator for rotary pumps. Twin type strainers provided to keep atomizer tips from clogging.

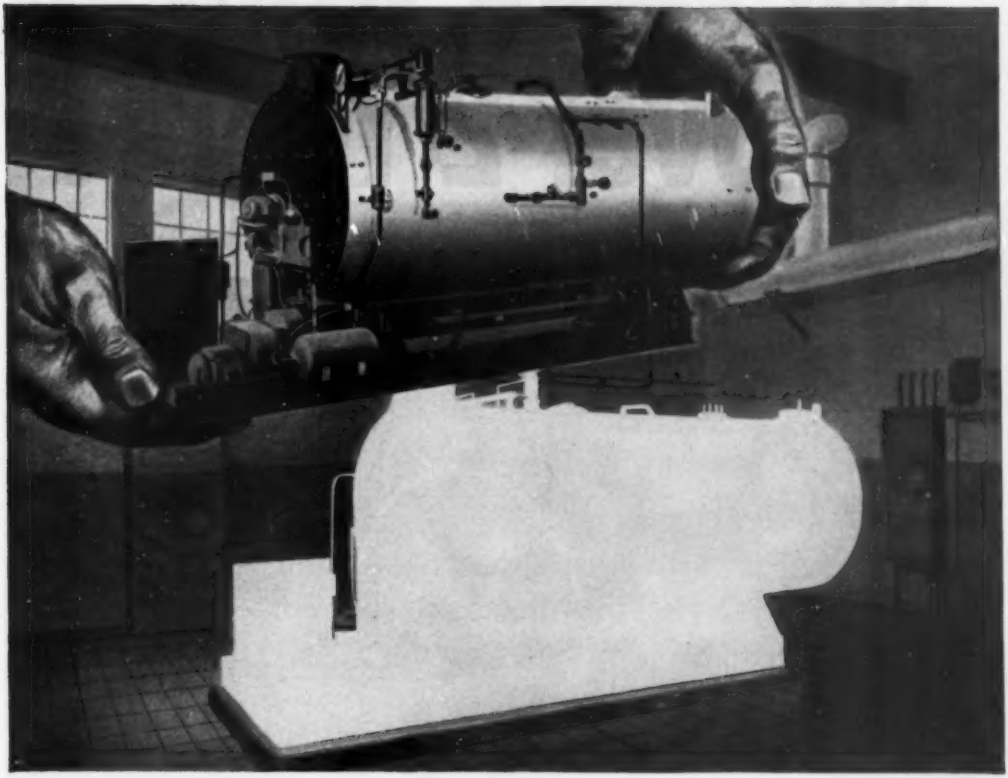
10. Cleaner Boiler Room . . . all overflows connected to a common outlet, flanged drip pan catches oil drip.

EC 488

THE ENGINEER COMPANY

75 WEST STREET, NEW YORK 6, N. Y.

Ready when you need it...



Save Installation-Construction Time — Expedite Emergency Installations — Serve Immediate Temporary Steam Needs — With a Cleaver-Brooks Self-Contained Boiler

WHEN speed is vital, you can save weeks of valuable installation time with a Cleaver-Brooks boiler — delivered to location as a complete, factory assembled and tested, self-contained unit, with much of the trim and accessories provided.

In an emergency the installation time can be reduced to as little as 48 hours, by following a properly planned and coordinated procedure of providing in advance the required facilities — foundations, headers, service and blow-off lines, fuel tanks and lines.

Prior to the completion of your building, Cleaver-Brooks boilers can be placed in operation to serve immediate steam needs. When permanently installed the change-over takes place with a minimum of labor and expense and the avoidance of interrupted steam service.

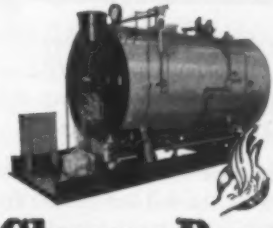
Cleaver-Brooks are the first and finest in modern, self-contained boilers — operate at a guaranteed efficiency of 80% — burn the fuel most available and economical in your area, gas, oil, or combination gas and oil — fully meet all codes — standard models available in sizes 15 to 500 hp; 15 to 250 psi.

CLEAVER-BROOKS COMPANY
Originators of the Self-Contained Boiler
Dept. L-302 E. Keefe Ave., Milwaukee 12, Wis., U.S.A.
Cable Address: Cleabro-Milwaukee, Wis.

Write for latest, fully illustrated and descriptive Cleaver-Brooks Steam Boiler Catalog.

WHY INSTALLATION TIME IS CUT:

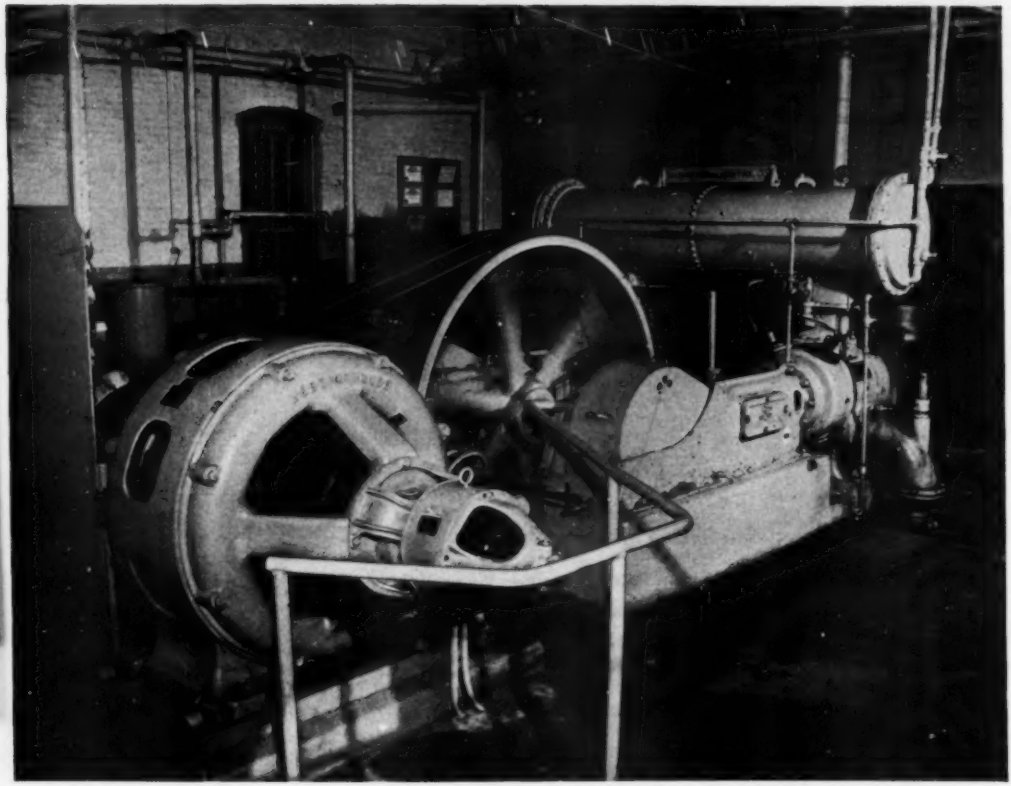
- Simple Low-Cost Stack
- No Job-Site Brickwork — No Special Foundations
- Boiler Delivered as a Complete, Factory Assembled, Tested, Self-Contained Unit
- Centralized Responsibility — No Waiting on Multiple Sources of Supply



Cleaver-Brooks

Builders of Equipment for the Generation and Utilization of Heat • Steam Boilers • Oil and Bitumen Tank-Car Heaters • Distillation Equipment • Oil and Gas-Fired Conversion Burners

"No Valve, Ring, or for Over 2 Years!"



The American Car and Foundry Company's huge plant at Huntington, West Virginia has been a user of Sinclair lubricants for over eighteen years. The results are of particular interest!

For example – the four compressors in the ACF plant are lubricated with Sinclair RUBILENE Medium. Proof of outstanding lubrication stamina is attested to by this service report: *"None of these compressors has required servicing of valves, rings, or bearings for over two years."*

Results speak volumes for this Sinclair Product. Why not investigate the advantages of RUBILENE Oils, available in *nine* viscosity grades? Contact your nearest Sinclair Representative or write Sinclair Refining Company, 600 Fifth Avenue, New York 20, N.Y.

SINCLAIR RUBILENES®

Bearing Service

...SAYS THE AMERICAN CAR AND FOUNDRY COMPANY

"Rubilene has given Trouble-Free Service."

Further proof of RUBILENE quality is found in the operation of two Betts Heavy Duty Hydraulic Feed Car Wheel Bores. The American Car and Foundry Company says, "RUBILENE Oil Extra Light has given trouble-free service as the hydraulic fluid since these machines were put in service. No problem either, with chatter or sticking air hoists—RUBILENE Oil Medium in the air line lubricators does this job admirably."

for low maintenance costs

TWO TERRY TURBINES IN RECORD NON-STOP RUN AT CITIES SERVICE

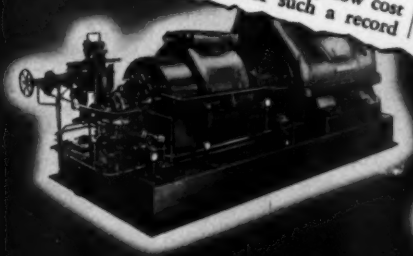
After 26 Months of Continuous Operation, Cost of Replacement Parts Only $78.00 for Each Turbine

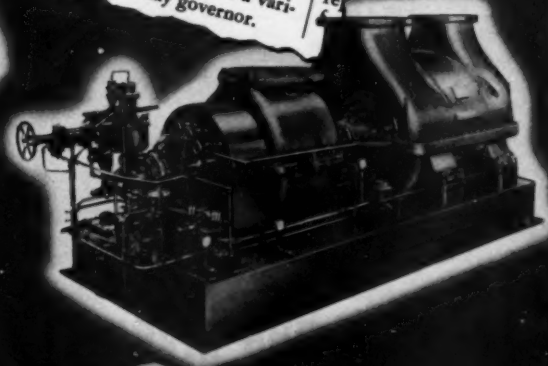
Two Terry turbines recently completed a record non-stop run at the East Chicago refinery of Cities Service Oil Company. Specially designed for driving air blowers on fluid catalytic cracking, they ran continuously *from initial start up*, day and night, for two years and two months. Throughout the entire run neither turbine suffered any noticeable reduction in efficiency.

On inspection, after shutdown, it was found that the only parts showing signs of wear were the shaft packing rings. These were replaced at a total cost of $78.00 for each turbine.

While this extremely low cost for repairs, after such a record run, could not have been anticipated, Cities Service had good reason to expect outstanding performance from Terry turbines. A four-year record of 216 Terry turbines at the Lake Charles refinery of this same company showed amazingly low maintenance costs. During this period, the yearly cost of replacement parts averaged only 1.4% of the initial investment.

The two turbines at East Chicago are rated 2450 horsepower at 5030 rpm. Each is equipped with a trip throttle valve, forced feed lubrication, and regulator for process control applied to a variable speed oil relay governor.





For more information about Terry multistage turbines, send for a copy of Bulletin S-146. No cost or obligation.

TERRY

THE TERRY STEAM TURBINE CO.
TERRY SQUARE, HARTFORD 1, CONN.

TT-1193

Hy-Test Steam Hose...

Can't Burst!

NEW YORK BELTING & PACKING CO. NYB&P INDUSTRIAL RUBBER PRODUCTS Since 1846

Hy-Test was developed to prevent the serious accidents that occur when steam hose explodes.

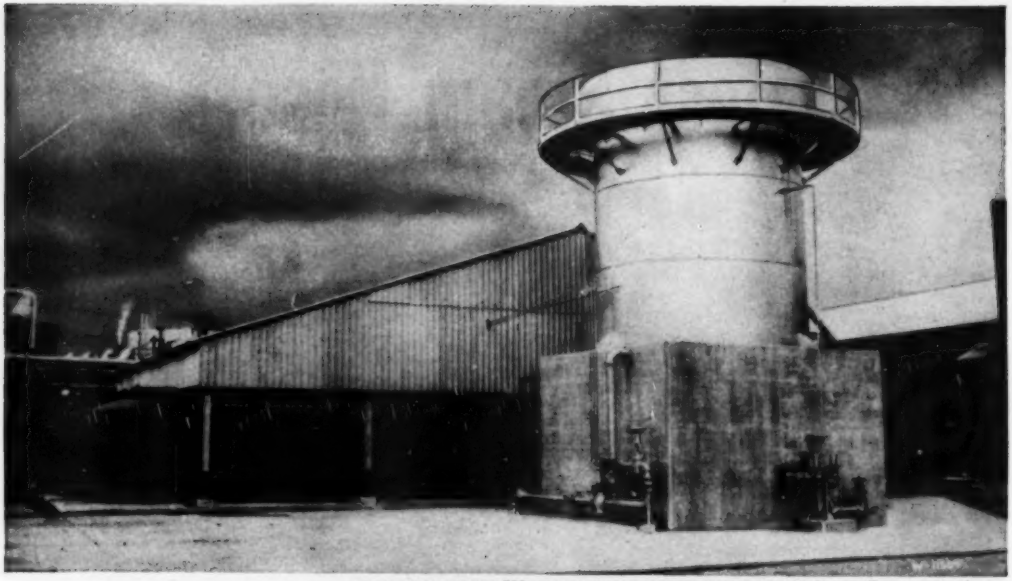
Supporting plies of closely braided steel wire withstand working pressures up to 200 pounds. Inner tube of specially compounded rubber is highly resistant to moist heat. When long service finally causes the tube to fail, the braided-wire plies permit the steam to merely *seep* through —giving workmen ample warning that replacement is needed. Hy-Test will never burst!

It is recommended for handling superheated or saturated steam in any heavy-duty industrial steam service.

Always see your local NYB&P Distributor when you require hose, belting, packing or any other industrial rubber products. He can save you time and money.

NEW YORK BELTING & PACKING COMPANY

1 MARKET STREET, PASSAIC, NEW JERSEY



SPECIALLY DESIGNED 500 GPM WORTHINGTON TREATING SYSTEM at the new Pemex natural gas refinery in Poza Rica, Mexico. System includes cold-process slurry-type softener followed by acid feed, filtration and zeolite treatment. Engineered by Arthur G. McKee Company.

Specially Designed for Intermittent Service

Softening system for boiler feed water built for short-period operation, long shutdowns

Water conditioning requirements are especially tough at the new Pemex natural gas refinery in Poza Rica, Mexico.

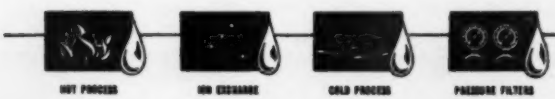
Their need for variable-rate, continuous-service softener operation is complicated by the intermittent boiler feed-water storage demands.

Pemex's conditioning requirements have been met by a specially built Worthington system, so designed that the slurry bed is not lost during "off-service" periods. The bed resumes its normal suspended position at the instant service is resumed. This avoids the irregular treatment, delay and water waste common in systems that require creation of a new slurry bed after each shutdown period.

New Bulletin W-212-B5 gives you the vital facts about this unique cold process water softening method. Write for your free copy today.

Worthington engineers and builds equipment for all the major types of water-conditioning systems, therefore is in an excellent position to give comprehensive and well-balanced recommendations on your water-conditioning equipment problems . . . further proof that *there's more worth in Worthington*. Worthington Corporation, Water Treating Section, Harrison, N. J.

A1.3



Worthington Makes More of the Equipment for ALL Types of Water Conditioning Systems

WORTHINGTON
Water Conditioning

STOP RUST! with RUST-OLEUM

Protects Tanks, Pipes, Girders, Metal Sash, Fences, Roofs and Buildings, Rail and Marine Facilities

BEAUTIFY AS YOU PROTECT—ALL COLORS, ALUMINUM AND WHITE!

RUST-OLEUM may be applied directly over *rusted surfaces without removing all the rust!* Just remove rust scale and loose particles with wire brush and sharp scrapers . . . then apply by brush, dip, or spray. Costly sandblasting and chemical pre-cleaning are not usually required. Easy as that to cut your maintenance costs. Specify **RUST-OLEUM** to your painting contractor or architect for *every rustable* metal surface! Prompt delivery from Industrial Distributor stocks in principal cities.

RUST-OLEUM CORPORATION
2475 Oakton Street • Evanston, Illinois

FREE SURVEY: A **RUST-OLEUM** specialist will gladly survey your rust problems. He'll make specific tests and recommendations. No cost or obligation. See Sweets for complete catalog and nearest **RUST-OLEUM** distributor, or write for literature on your company letterhead.

Stopping Rust with **RUST-OLEUM** 769 D. P. Red Primer

CLIP THIS TO YOUR LETTERHEAD
MAIL TO: RUST-OLEUM CORPORATION
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- ☐ Have a Qualified Representative Call
- ☐ Full Details on Free Survey
- ☐ Complete Literature
- ☐ Nearest RUST-OLEUM Source

Look for this label – be sure it's genuine **RUST-OLEUM**

The Ten Leading Makes Of Vertical Turbine Pumps

√ Indicates Feature Is Standard

Standard Features	Worthington	Pump A	Pump B	Pump C	Pump D	Pump E	Pump F	Pump G	Pump H	Pump I
Seals above and below drain ports (oil-lubricated model)	√				√					
Wearing rings	√				√			√		
Enclosed impellers	√	√	√	√	√	√		√	√	√
Bronze bushings in bowl assembly	√		√	√	√	√		√	√	√
Flanged and bolted bowls on all sizes	√						√		√	√
Sand collars at both ends of bowl assembly (water-lubricated model)	√	√								
Grease-packed bottom bearing	√	√		√						
Choice of oil or water lubrication	√	√	√	√	√	√		√		

CHECK WORTHINGTON AGAINST THE REST

Only Worthington has all 8 vital design features as standard equipment.

Have you ever considered a vertical turbine pump for your industrial applications?

If you haven't, you may be missing a good bet.

For many years the vertical turbine pump was thought of as having only one application—deep well pumping. Recently, however, this efficient liquid handler has been given many other jobs, so that today we're not sticking our necks out when we say: it's an extremely *versatile* pump.

Let's take a look at the four inherent characteristics that make this pump really *versatile:*

1. THE DRIVE UNIT IS REMOTE AND SEPARATE FROM PUMPING ELEMENT. The pump always operates submerged. No priming. No expensive dry pits. No suction or NPSH problems.

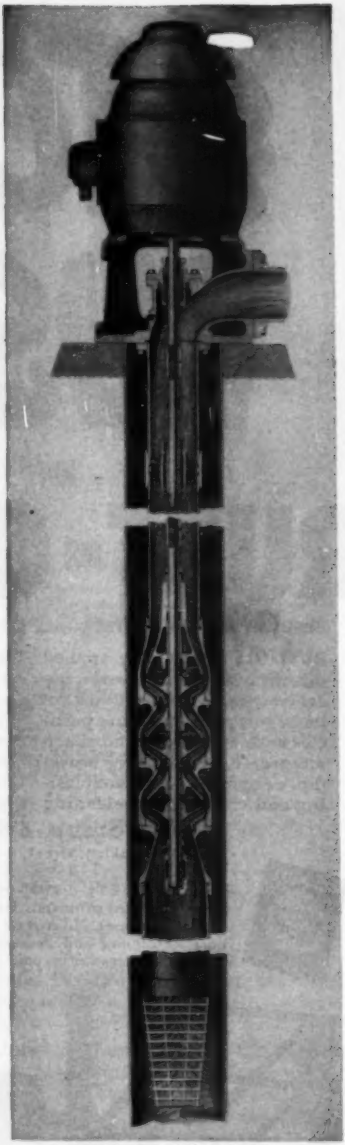
2. SPACE REQUIREMENTS AT A MINIMUM. Because of its vertical design, the vertical turbine pump takes less floor space than other types.

3. MECHANICAL AND HYDRAULIC FLEXIBILITY. Will operate with any type of drive. Discharge can be positioned to user requirements. Can be close coupled or several hundred feet long. Meets head and capacity requirements by varying the number of duplicate stages.

4. IT'S A SIMPLE MACHINE. Unidirectional thrust minimizes alignment problems. Easy maintenance, few moving parts, little friction, long life.

If you think a Worthington vertical turbine might be your answer to a pumping problem, or if you're not quite sure about it—we'd like to hear from you. Remember, Worthington, as the oldest manufacturer of pumping equipment, has the newest and broadest line of vertical turbine pumps.

Send complete data on your application mentioning capacities. Worthington Corporation, formerly Worthington Pump and Machinery Corporation, Vertical Turbine Pump Division, Denver 16, Colorado; Succasunna, N. J.



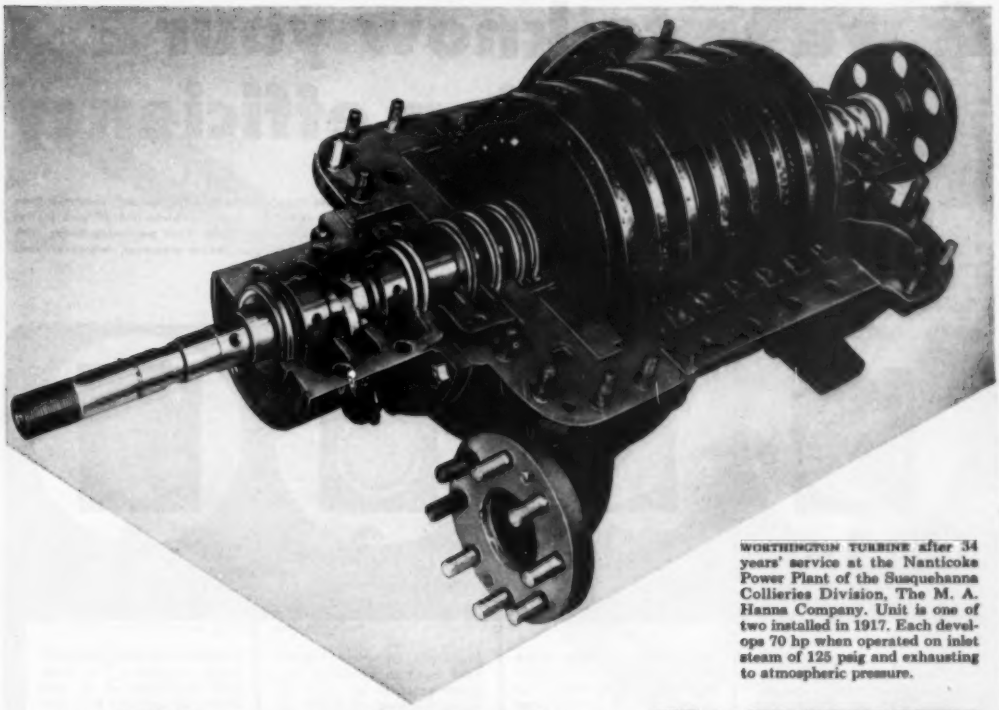
TYPICAL SECTION of the Worthington water-lubricated vertical turbine pump that gives most efficient pumping performance at lowest possible cost.

D.1.11

The World's Broadest Line Assures You The Right Pump For Every Job

WORTHINGTON

Vertical Turbine Pumps



WORTHINGTON TURBINE after 34 years' service at the Nanticoke Power Plant of the Susquehanna Collieries Division, The M. A. Hanna Company. Unit is one of two installed in 1917. Each develops 70 hp when operated on inlet steam of 125 psig and exhausting to atmospheric pressure.

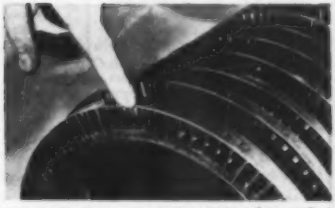
This reconditioned Worthington Turbine has seen 34 years' service

Installed in 1917, this Worthington steam turbine will probably go on to serve the Nanticoke Power Plant of the Susquehanna Collieries Division, The M. A. Hanna Company, for many years to come.

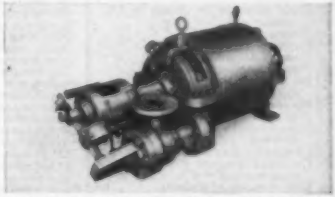
This unit is one of two that for 34 years have been driving induced draft fans—and was recently returned to Worthington's Wellsville, N. Y., plant for reconditioning.

Whether your requirements call for 70 hp or 24,000 hp, the complete Worthington line offers you the right steam turbine for your mechanical drives—a rugged performer that's ready to serve you economically and give you years of uninterrupted service.

Worthington Corporation, Steam Turbine Division, Wellsville, New York.



CLOSE-UP OF TURBINE BLADING shows that, except for a few single insertions, it remains the same as when turbine was installed 34 years ago.



COMPLETE TURBINE—ONE OF THE TWO that have been driving fans for Susquehanna Collieries since 1917.

T.2.3

A GREAT TEAM IN STEAM

WORTHINGTON

Steam Turbines

4 ways to know your combustion efficiency

The ever-increasing pressure for fuel economy makes some type of "combustion guide" instrument an essential part of any modern fuel burning operation. Hays offers the most complete line of such instruments in the industry—adaptable to your cost and engineering requirements. Your particular needs with regard to price, accuracy, speed of response, etc., will determine your choice—however, whatever your needs, Hays has the instrument.

Select your combustion guides *from the most complete line in the industry*

Measures fundamental indicator of combustion efficiency—Oxygen. Electronic in operation, with all of the most advanced features incorporated into its design, it is applicable not only to power plant conditions but also to a host of process problems such as catalytic crackers, open hearths, process heaters, inert gases, etc.

PRINCIPLE

Based on paramagnetic (attracted by magnetism) properties of oxygen. All other gases usually encountered are slightly diamagnetic (repelled by magnetism).

FEATURES

Highly sensitive to change in O_2 content
Rapid response to change in O_2 content
Electrically operated
Electronic type recorder
Temperature controlled
Pressure compensated
No liquid or gaseous fuel required to be added
No chemicals
High accuracy maintained
Not affected by wide change of gas flow rate
Continuous sampling and recording
Glass and corrosive resistant sampling system
Remote mounted analyzer
Remote mounted recorder
12" 24-hour chart
O_2 recorder and indicator
4 records on same chart possible
Low maintenance

Meter incorporates all of the construction and manufacturing ideas which Hays has developed during many years of experience in gas analysis. A deluxe instrument, the Condu-Therm CO_2 Analyzer is especially applicable to the larger boiler plants and to industrial processes.

PRINCIPLE

The principle of operation used in the Hays Condu-Therm Meter is that of thermal conductivity of gases, i.e., that all gases conduct heat at different rates.

FEATURES

Electrically operated
Electronic type recorder
Temperature controlled
Humidity controlled
No chemicals required
No moving parts in analyzer
Continuous sampling
No drying agent required
Easily installed glass and corrosion resisting sampling system
Not affected by wide change in gas flow rate
Rapid response
High sensitivity
Continuous recording
Remote mounted analyzer
Remote mounted recorder
12" 24-hour chart
CO_2 Recorder and Indicator
As many as 4 records on same chart
Low maintenance

Hundreds of these meters have been in operation for many years in all types of plants burning all kinds of fuels and saving thousands of fuel dollars.

PRINCIPLE

Operates on Orsat principle of Volumetric measurement and chemical absorption. Extremely simple: sample of flue gas trapped and accurately measured; passed through chemical which removes CO_2 component of gas mixture. Sample is re-measured, volume compared to original sample. Difference before and after absorption gives exact percentage of CO_2 absorbed by chemical.

FEATURES

Low price
Water operation
Pressure and temp. compensated
Volumetric determination
Chemical absorption
2 minute operating cycle
Easily understood
Rugged construction
Low maintenance
Available in 6 remote mounted types and 3 integral types
Remote or integral mounting
10" 24-hour chart
Available for: (a) CO_2 only—recording with or without indicator (b) CO_2 and flue gas temperature recorder combined (c) CO_2, draft or flue gas temperature recorder combined

Provides a QUANTITATIVE guide to efficiency — deals with quantities of air and steam; by contrast CO_2 and O_2 meters are QUALITATIVE guides since they determine directly quality of combustion gases. Both Boiler Efficiency Meter and Gas Analysis Meter are used to obtain advantages of both methods.

PRINCIPLE

Pounds of air required to burn each pound of coal vary widely with heating value of coal; constant weight of air is required to produce same Btu. Similar relationship exists when oil and natural gas are used as fuels. Record of steam flow is assumed to be Btu's produced; record of air flow is calibrated to flow of air required to generate that steam.

FEATURES

Electric operation of flow meter and air flow recorder
Diaphragm type air flow measuring unit
Air flow measuring element does no work
Air flow recorder—motor operated
Adjustable cam air flow calibration
Mercury transmitter—pressures to 2500 psi
Interchangeable range tubes for steam flow
Remote mounted steam flow transmitter
No high pressure piping into panel
Easily installed and adjusted
Low maintenance

THE HAYS CORPORATION
MICHIGAN CITY 2, INDIANA

Automatic Combustion Control • Boiler Panels • Hays-Penn Flowmeters Veriflow Meters and Veritrol • Gas Analyzers • Draft Gages Combustion Test Sets • CO_2 Recorders • Electronic Oxygen Recorders

DRAW A BEAD ON BOILER CARRYOVER

CARRYOVER refers to the entrainment of boiler water in the steam from any source, especially when it is due to foaming, priming or other causes. No matter what "IT" is called, anything other than dry steam going over from the boiler may lead to difficulties!

Use DREW POWER CHEMICALS

Almost all suspended and soluble materials in your boiler water system contribute to Carryover. They may lead to expensive trouble in boiler, steam and condensate lines and equipment and processes using steam. It's the duty of every good water treatment company to recognize and solve this problem.

Draw a bead on Carryover! Call the Drew engineer. The water samples and operating data that he obtains in your plant will be thoroughly analyzed in the Drew laboratories. You'll be given specific recommendations for corrective and preventive treatment . . . involving the use of Organics or Anti-Foams where necessary. And you'll receive continuous and frequent service, too!

Thorough investigation, proper treatment and frequent service have made Drew one of America's fastest growing water treatment companies. Consult the nearest Drew engineer, or write for information.

Power Chemicals Division

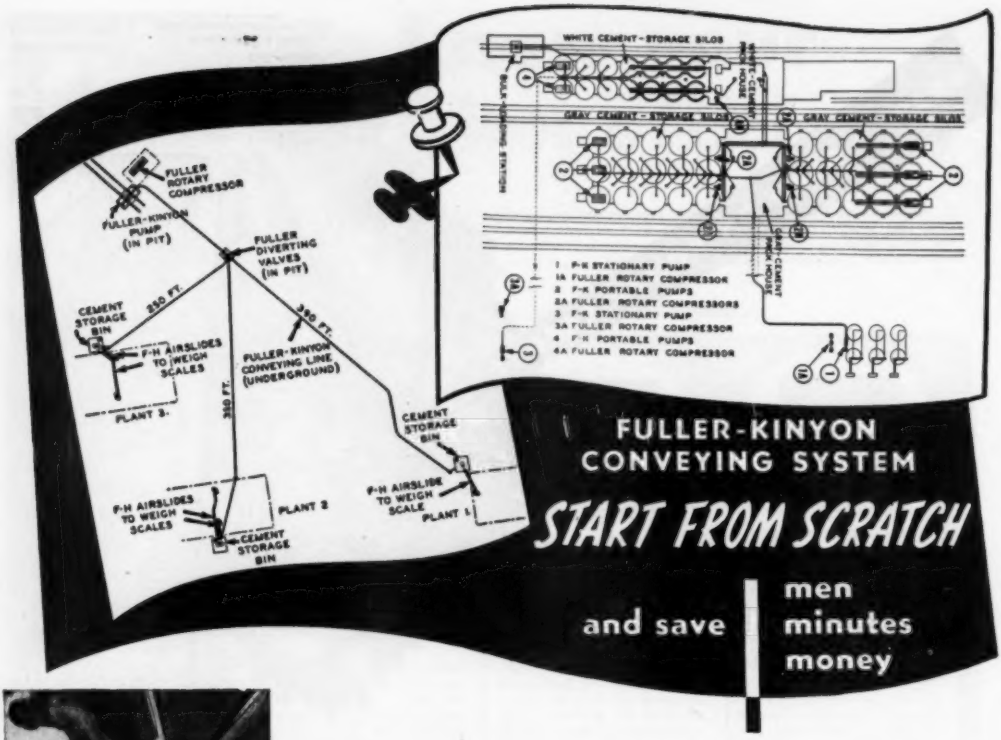
E. F. DREW & CO., INC.

15 East 26th Street, New York 10, N. Y.

SAN FRANCISCO CHICAGO PHILADELPHIA BOSTON DALLAS
AJAX, ONTARIO

Service throughout the United States, Canada and South America

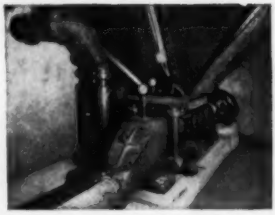
DREW PRODUCTS



FULLER-KINYON CONVEYING SYSTEM

START FROM SCRATCH

and save | men | minutes | money



Fuller-Kinyon Stationary Pump conveying from bin.

Fuller-Kinyon Unloader unloading from box car.

The best way to solve any problems of conveying dry pulverized and granular materials is to "Start From Scratch". By that we mean, get all the facts on pneumatic conveying systems while you are still in the planning stage . . . either when building a new plant or modernizing an old one. Pneumatic conveyors permit economy and convenience in location of buildings and production equipment without the restrictions or straight-line limitations of mechanical conveyors. The layout of the conveying system can be designed to meet the specific requirements of the job, to conform exactly to local conditions, to insure minimum cost for erection, maintenance, and supervision.

Right there is where Fuller comes into the picture. As engineers and builders of four basic types of pneumatic conveying systems, Fuller is able to provide the exact system best suited to individual requirements.

Shown here is the Fuller-Kinyon System for conveying dry pulverized materials. It has many advantages: conveying pipe lines can be located anywhere—underground, suspended on simple hangers overhead, vertically, around corners, over long distances, and to practically any number of delivery points. There are no mechanical or explosion hazards. Conveying is clean, fast, and at minimum cost per ton of material handled.

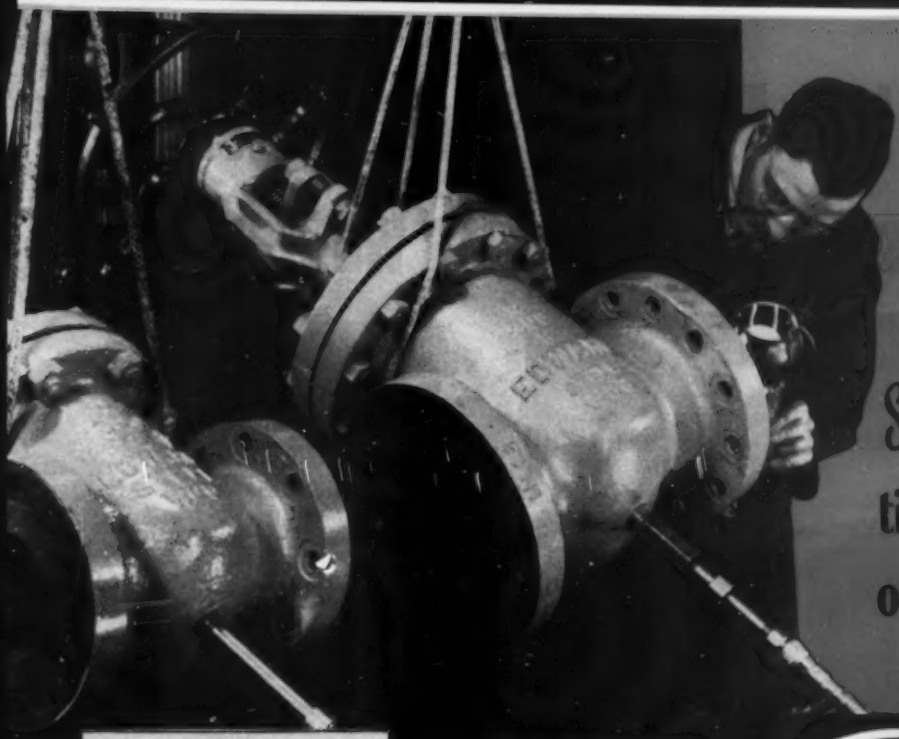
We invite you to have Fuller Engineers make a complete survey and study of your plant plans—investigate local conditions and the material to be handled. Then they will make recommendations as to the system best adapted to your needs—enable you to save time, money, and material by having both plant and system built at the same time. To consult them places you under no obligation.

FULLER COMPANY, Catasauqua, Pa.
120 So. LaSalle St., Chicago 3 420 Chancery Bldg., San Francisco 4

P-130

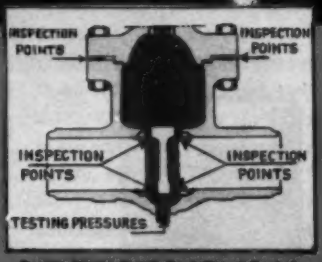
Fuller

DRY MATERIAL CONVEYING SYSTEMS AND COOLERS — COMPRESSORS AND VACUUM PUMPS — FEEDERS, AND ASSOCIATED EQUIPMENT



EXCLUSIVE TEST METHOD PROVES *Simultaneous* tight seating of both faces of

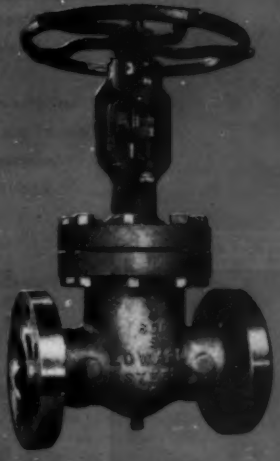
Edward GATE VALVES



Pressures injected through the bottom of the body compared seats, yet leaves both seats open for simultaneous inspection in Edward testing method.

Arrows show where Edward air undercuts between wedge and guide ribs to eliminate wedge drag on seats. With Edward gate valve, partial turn of handwheel transfers load from seats to wedge guides.

Edward gate valve wedge guides are welded to body after seats are in place; therefore moving parts are accurately located. Seat rings are also welded in to prevent leakage between seats and body.



When Edward engineers began the design of a new series of steel gate valves they tested other makes. Many of them were tight on one seating face or the other, but few were tight on both faces.

To build really tight gate valves, Edward engineers discarded the conventional method of casting guide ribs as part of the body and instead developed a new technique for welding the ribs into the body *after the machined seating faces were in place*. This, they demonstrated, reduced machining tolerances, eliminated wedge drag on the seating faces, and cut wear. They were also sure it meant a tighter valve.

But how to prove it? The result was the testing method shown above. Now, *all* Edward gate valves are tested with both ends open for simultaneous inspection, and both seating faces must be tight simultaneously.

The new Edward gate valves incorporate many other plus-value features, such as welded-in seats, one-piece bonnets, ball bearing yoke bushings in most sizes, and Stellite faced seating surfaces. With Edward, these features are standard construction.

For more details write for Catalog 12-E.

Edward Valves, Inc.

EAST CHICAGO, INDIANA

40 West 144th Street

See how TRANE Unit Heaters deliver heat where it's wanted...

Throws heat without diffuser

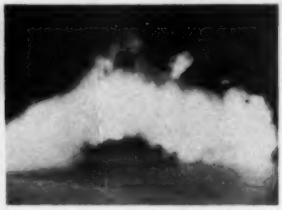
With louver cone: 60% extra throw

Forces heat to wide area

"Spots" heat to one side

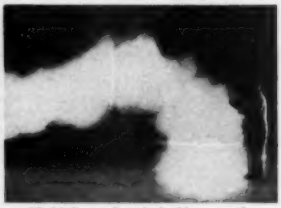
Patented Louver Cone on TRANE Projection Heater concentrates hot air stream for additional throw. Diffuses heat gently, directs it where needed, pinpoints cold spots—all with finger tip control. It taps waste ceiling heat, projects it down to floor line. Ideal for craneways, aisles, bays, and hundreds of other hard-to-heat places.

Diffuses heat in blanket



Split stream does double duty

Up to 25% more throw



Half flow ahead, half at angle

Patented Louver Fin Diffuser gives new versatility to the TRANE Model H horizontal discharge unit heater. Countless diffusion patterns are now available—divided streams, gentle blanket, spot throw. TRANE also makes the Torridor, a blower unit for large volume heating; deluxe cabinet units and new, improved gas fired units. All in a complete range of capacities.

TRANE Bucket and Float Traps—Matched for perfect service with TRANE Unit Heaters; high or low pressure.

For complete information about how TRANE Unit Heaters and Diffusers can solve your heating problems, see your nearest TRANE sales office or write TRANE, La Crosse, Wisconsin.

MANUFACTURING ENGINEERS OF HEATING, VENTILATING AND AIR CONDITIONING EQUIPMENT

TRANE

THE TRANE COMPANY, LA CROSSE, WIS.
Eastern Mfg. Division, Scranton, Pa.
Trane Company of Canada, Ltd. . . Toronto
Offices in 80 U.S. and 14 Canadian Cities

STEAM POWER
for Kaiser Aluminum

15 FOSTER WHEELER STEAM GENERATORS SERVE THE SOUTH'S BIG NEW INDUSTRY AT CHALMETTE, LA.

For every pound of aluminum produced in this new 400,000,000 pound-per-year plant, Kaiser will need about 10 kwh of electric power.

To meet this enormous, almost constant demand, Kaiser Engineers selected a plant consisting of gas-burning radial engines, and 15 Foster Wheeler "D" type boilers to supply steam for the turbine-generators.

These boilers, with a combined capacity of 3,375,000 lb of steam per hr, are ideally suited for Kaiser's requirements for reliability, ease of operation and high availability. And they are a natural for use in the South where a temperate climate permits low-cost, semi-outdoor-type installations.

This installation is another example of Foster Wheeler's ability to design and construct power-producing equipment to meet the needs of industry.

Aerial view showing first six boilers and six of the eight stacks under construction. Nine more boilers, now being fabricated, will be located in extension of the present line. Turbine room is to the left.

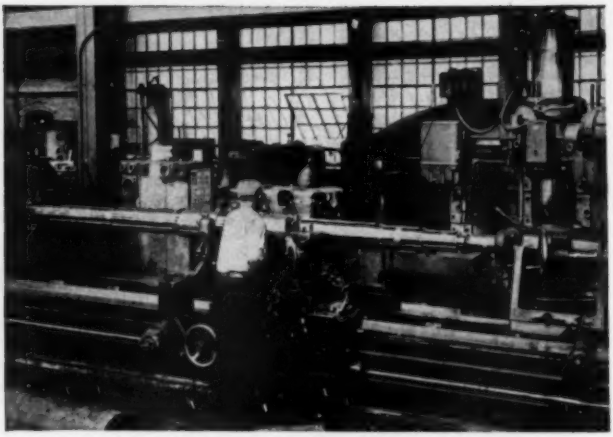
Cross-section of one of the 15 duplicate Foster Wheeler "D" type steam generators for Kaiser Aluminum. The regenerative air heater is not shown.

CAPACITY	225,000 lb per hr
PRESSURE	900 psig
FINAL STEAM TEMPERATURE	905 F
TEMPERATURE FEEDWATER INLET	350 F
FIRING	Natural Gas

For information on your steam generation requirements, write to: FOSTER WHEELER CORPORATION, 165 BROADWAY, NEW YORK 6, NEW YORK

FOSTER WHEELER

When you need a tough, fatigue- and corrosion-resisting alloy —try "K" Monel



This is the largest INCO Nickel Alloy pump shaft in the world. The shaft is 13 feet 7⅛ inches long, 9.005 inches at its widest diameter, and weighs 3,343 lbs. It was forged by INCO'S Huntington Mill from "K" Monel for Consolidated Edison Co., after other materials repeatedly failed. Neither "K" Monel nor Monel have ever been known to fail from corrosion fatigue in salt water.

Are there applications in your operation where metal is subject to fatigue, corrosion and erosion?

Then chances are "K" Monel is the alloy you need.

"K" Monel is a tough, corrosion-resisting wrought alloy of Nickel, copper and aluminum. It offers you the excellent corrosion resistance of regular Monel, together with the added advantages of greater stiffness and hardness through heat treating.

As evidence of the value of "K" Monel's added advantages, take a pump shaft operating in highly corrosive and polluted salt water.

New York City's Consolidated Edison Company has two big 80,000-gallon-per-minute condenser circulating water pumps. For years engineers kept replacing the shafts with materials of increasing strength but failures would continue to occur in the same spot because of corrosion fatigue.

Finally, they decided to try "K" Monel.

A 1½-ton heat-treated "K" Monel shaft with a tensile strength of 140,000 pounds per square inch was installed in September of 1949 and has been functioning perfectly ever since. In fact, the pump casing has not even been opened for inspection since installation.

Let's take a quick look at a few of the principal characteristics of "K" Monel:

Age-hardenable, or capable of having its hardness and mechanical properties increased simultaneously as the result of thermal treatment, "K" Monel is equal in strength and toughness to many heat-treated alloy steels. It shows improved strength and hardness at sub-zero temperatures with no loss of toughness. And it provides moderate strength at temperatures up to 900° F.

"K" Monel is non-magnetic under ordinary conditions, and remains so down to —150° F.

The working characteristics of "K" Monel are excellent, too. It is readily machined in an annealed condition, but in other conditions may be considered commercially machinable at practical (although generally somewhat slower) rates. It can be joined by the usual welding, brazing and soldering processes.

You'll find all essential engineering data on "K" Monel and its more machinable companion alloy, "KR" Monel, in the 24-page reference manual, "Engineering Properties of 'K' Monel and 'KR' Monel." Write for your copy.

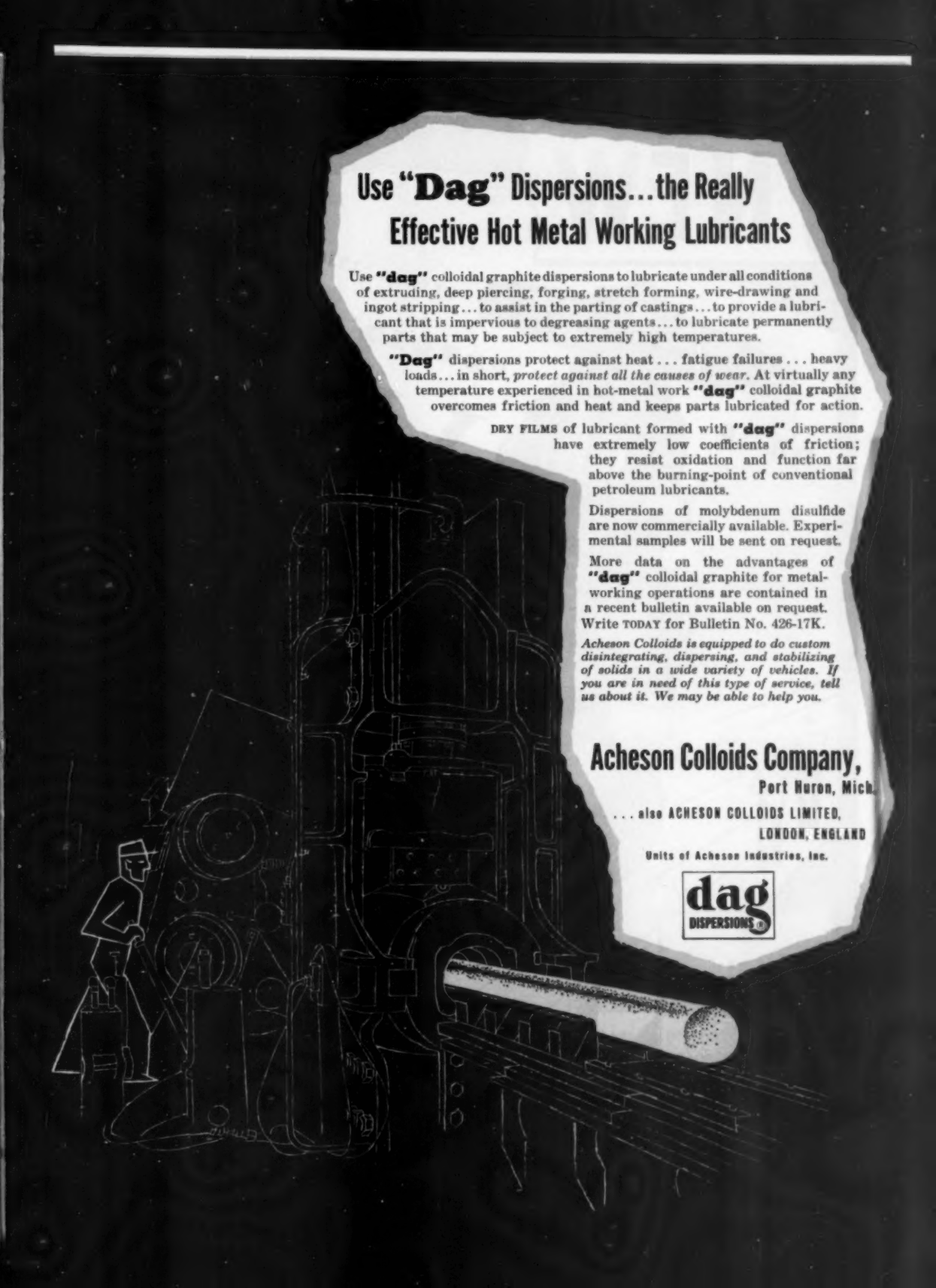
One last—and important—point. "K" Monel, like other INCO Nickel Alloys, is now on extended delivery because of defense needs. So it is important to include NPA rating and complete end-use information with all orders.

The International Nickel Company, Inc.

67 Wall Street, New York 5, N. Y.

Nickel INCO TRADE MARK Alloys

MONEL® • "R"® MONEL • "K"® MONEL
"KR"® MONEL • "S"® MONEL • NICKEL • LOW CARBON NICKEL • DURANICKEL® • INCONEL® INCONEL "X"® • INCOLOY • NIMONICS®


Use "Dag" Dispersions...the Really
Effective Hot Metal Working Lubricants
Use "dag" colloidal graphite dispersions to lubricate under all conditions of extruding, deep piercing, forging, stretch forming, wire-drawing and ingot stripping... to assist in the parting of castings... to provide a lubricant that is impervious to degreasing agents... to lubricate permanently parts that may be subject to extremely high temperatures.
"Dag" dispersions protect against heat... fatigue failures... heavy loads... in short, protect against all the causes of wear. At virtually any temperature experienced in hot-metal work "dag" colloidal graphite overcomes friction and heat and keeps parts lubricated for action.
DRY FILMS of lubricant formed with "dag" dispersions have extremely low coefficients of friction; they resist oxidation and function far above the burning-point of conventional petroleum lubricants.
Dispersions of molybdenum disulfide are now commercially available. Experimental samples will be sent on request.
More data on the advantages of "dag" colloidal graphite for metal-working operations are contained in a recent bulletin available on request. Write TODAY for Bulletin No. 426-17K.
Acheson Colloids is equipped to do custom disintegrating, dispersing, and stabilizing of solids in a wide variety of vehicles. If you are in need of this type of service, tell us about it. We may be able to help you.
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DISPERSIONS

NEW

SERIES 12100*

FORGED STEEL

DROP

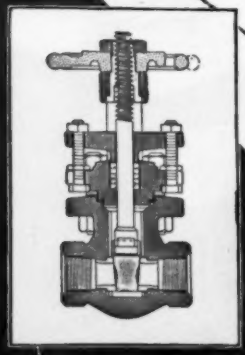
Vogt

BOLTED BONNET
BOLTED GLAND

150-800 POUND

GATE VALVES

SIZES ¼" to 2"



*Series 12100

CARBON STEEL | 800 Pounds @ 750° F.
1500 Pounds Cold Non-Shock

For 150-800 pounds service • Round Bolted Bonnet • Bolted Gland • Gasket or Ground Joint • Outside Screw and Yoke • Renewable Seat Rings • Solid Wedge — Slotted Type • Rising Stem 11½-13% Chrome Stainless Steel Trimmings • Sizes ¼" to 2" inclusive.

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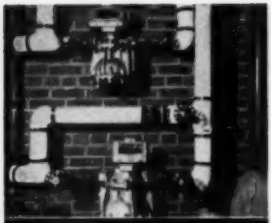
John Zink and his engineers solve an old and vexing problem by providing combustion without smoke in the modern Smokeless Field Flare Burner.

JOHN ZINK COMPANY

4401 So. Peoria Tulsa, Oklahoma



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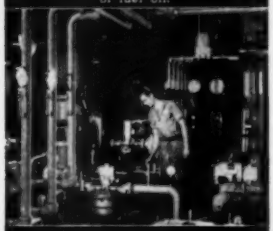
XACTO METER for accurate control in transfer and storage of fuel oil.



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BLENDERS for the continuous blending of 2 or MORE liquids.

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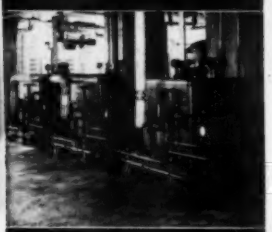
FILTERS for continuous coolant filtration systems.



POWER GENERATING
OIL CONDITIONER keeps turbine bearing oil clean — minimizes costly failures.

POWER EQUIPMENT
HYDRO-VOLIFIER portable oil conditioning unit for transformers, circuit breakers and switch gears.

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ESTABLISHED 1885

Specialists in . . .

LUBRICATION
FILTRATION
OIL STORAGE
METERING
for industry!

Bowser lubrication and liquid control systems are known for dependability in every type of industrial plant. Operating men have learned to rely on Bowser equipment . . . they know it minimizes downtime . . . lowers maintenance costs — stays on the job day-in-and-day-out.

Installations of Bowser equipment range from individual units to complete systems that serve entire plant facilities.

Bowser can furnish complete engineering service and can supply all the necessary equipment for proper installations. You are assured of complete satisfaction, too, because Bowser will assume the entire responsibility of efficient operation.

Bowser men have "know-how" in the handling of liquids. Consult NOW with the BOWSER man in your territory — there's no obligation!

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REGIONAL OFFICES • Atlanta • Chicago • Cleveland • Dallas • Kansas City • New York • San Francisco • Washington, D. C. • Hamilton, Ontario

TYPE E turbines can handle it!

In the powerhouse of William F. Schrafft & Sons, makers of the famous "Schrafft's Chocolates," Charlestown, Massachusetts, the Type E turbine is used on a 40-kw, d-c exciter. The turbine exciter is supplementary to a motor-driven exciter for one 750- and two 1000-kw Westinghouse Turbine-Generators.

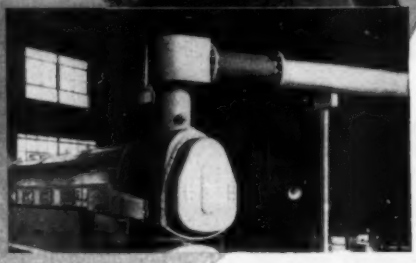
Of this installation, both the Chief Engineer and the Chief Power Plant Operating Engineer stated, "We are impressed by the design, appearance, and smooth-running qualities of the Type E turbine, and also the unique design of the oil-relay governor and forced-feed lubrication which the Type E provides." This all-Westinghouse end of Schrafft's power plant includes a new 1000-kw Westinghouse Geared Turbine-Generator, served by existing Westinghouse switchboard equipment and motor-generator sets.

Here's the general-purpose turbine that meets the many stern demands of modern industry. Regardless of operating conditions, the Type E is built to give dependable, trouble-free, economical performance for long periods of continuous operation . . . or instant operation when used as a stand-by drive.

Other types in the complete Westinghouse general-purpose turbine line include heavy-duty and multi-stage units for applications requiring higher temperatures and pressures, higher speeds, greater horsepower, extraction for process applications or higher efficiency than can be obtained with single-stage machines. Get the facts on this broad turbine line . . . call your nearby Westinghouse Office, or write Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania. J-50340

YOU CAN BE SURE...IF IT'S
Westinghouse
TYPE E Turbines

Large Diameter CMH REX-WELD CORRUGATED FLEXIBLE METAL HOSE

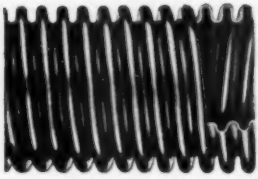


the answer to motion control for:

Diesel Engine Air Intake and Exhaust Lines • Tank Settling Connections • Safety Valve Vent Piping • Compressor Vibration Connections • Heavy Duty Loading and Unloading • And Many Other Services

Wherever large diameter connections must have the flexibility to absorb vibration or expansion and contraction, correct for misalignment or allow movement, and yet provide the rugged durability of metal, CMH REX-WELD Type RW-75 is the answer. REX-WELD Type RW-75 is the flexible connection that requires no packing, no periodical maintenance. All metal construction is completely gas and liquid tight.

For full information and data sheets see your local CMH distributor—look for his name in your classified telephone directory—or write direct.



CMH REX-WELD Type RW-75 is helically corrugated flexible steel hose and is made in sizes from 5" to 24" I.D., inclusive. Furnished with standard pipe nipples, couplings, fixed or floating flanges. Flanges to customers design can also be attached. Where required RW-75 can be supplied with metal braid covering.

Flexonics Corporation EXPANSION JOINT DIVISION 1335 S. THIRD AVENUE • MAYWOOD, ILLINOIS

FORMERLY CHICAGO METAL HOSE CORPORATION

Flexon identifies products of Flexonics Corporation that have served industry for over 50 years.

Manufacturers of Convoluted and Corrugated Flexible Metal Hose in a Variety of Metals • Expansion Joints for Piping Systems • Stainless Steel and Brass Bellows • Flexible Metal Conduit and Armor • Assemblies of These Components

In Canada: Flexonics Corporation of Canada, Ltd., Brampton, Ontario

Does Your Present Heat Insulation Have All These Advantages?

Kaylo Heat Insulation is a hydrous calcium silicate — a revolutionary heat-saving material — outstanding both in performance and ease of application.

KAYLO PIPE INSULATION is made to Simplified Dimensional Standards of thicknesses and diameters for snug nesting, when necessary.

1. **LOW "K" FACTOR**—Billions of sub-microscopic air spaces which compose the structure of Kaylo Heat Insulation give it exceptional insulating value.
2. **TEMPERATURE RANGE UP TO 1200° F.**—Kaylo Heat Insulation eliminates the need for combination coverings in nearly all operating conditions.
3. **LONG SERVICE LIFE**—Kaylo Heat Insulation remains dimensionally stable, strong and efficient over the years—although exposed to temperatures up to 1200°F.
4. **INSOLUBILITY IN WATER**—Even when saturated, Kaylo Heat Insulation retains about 85% of its strength. It returns to its original strength after drying.
5. **HIGH STRENGTH**—Breakage of Kaylo Heat Insulation is almost negligible in shipping and installation—workmen can walk on insulated equipment without causing breakage.
6. **LIGHT WEIGHT**—Since Kaylo Heat Insulation weighs only 11 pounds per cubic foot, it is exceptionally easy to handle and apply.
7. **WIDE RANGE OF SIZES AND SHAPES**—Kaylo Heat Insulation's unmatched selection of sizes and shapes reduces the number of pieces required per job.
8. **EASE OF CUTTING AND FITTING**—Ordinary tools of the trade are used to install Kaylo Heat Insulation. The material is non-irritating to the skin and non-toxic.

For complete details on all of the advantages of Kaylo Heat Insulation, write Dept. N-313, Owens-Illinois Glass Company, Kaylo Division, Toledo 1, Ohio.

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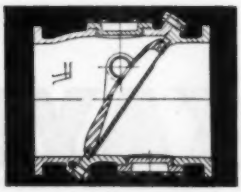

Cross-section of the Chapman Tilting-Disc Check Valve. A feature of the design is that the disc seat lifts away from the body seat when opening, and drops into contact when closing, with no sliding or wearing of the seats.

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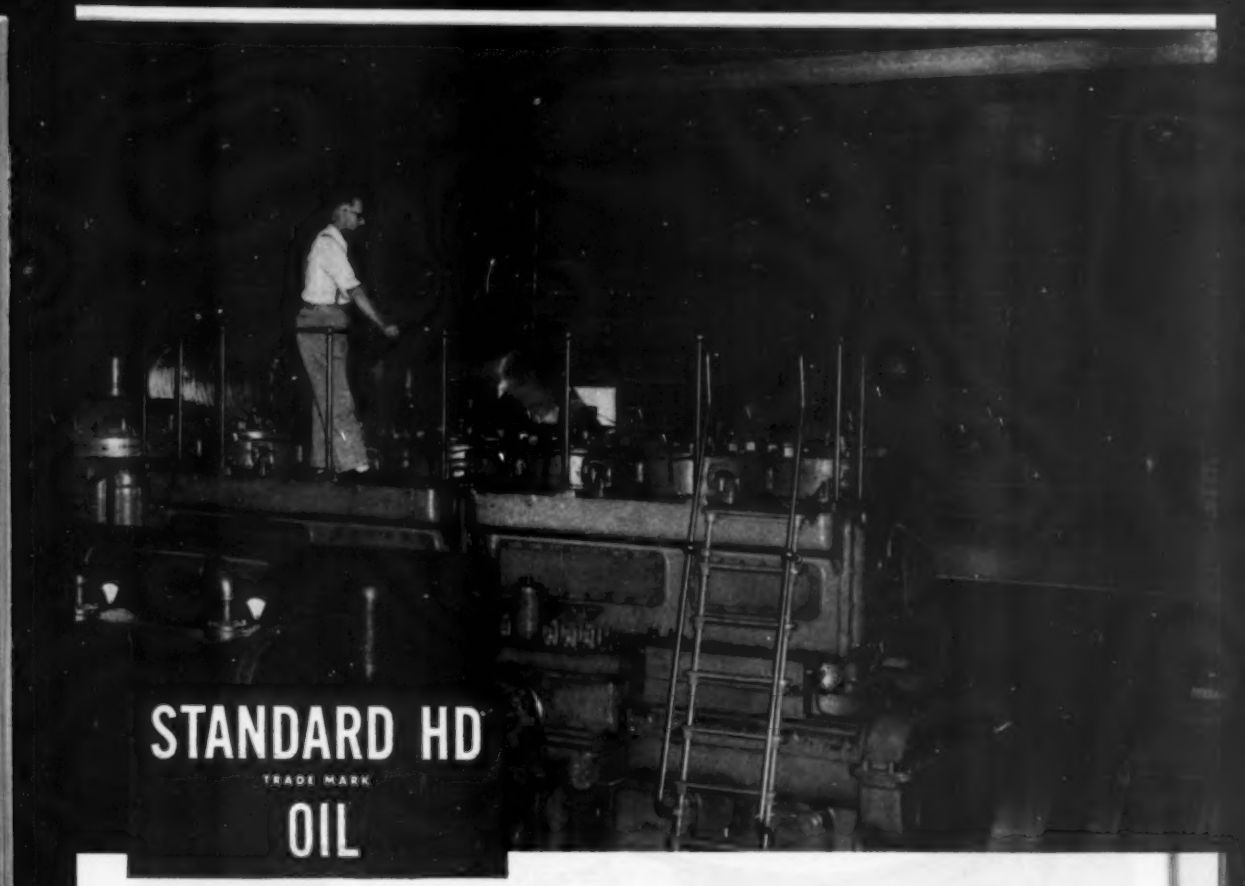

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SPREADER STOKERS

J. L. BAINBRIDGE, ***Philadelphia District Manager***
Detroit Stoker Company

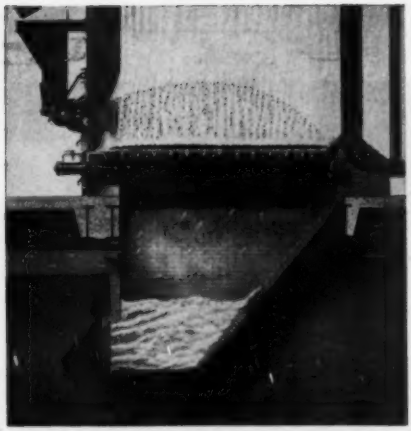
IN RECENT YEARS there has been a definite trend toward spreader stoker firing of bituminous and lignite fuels in steam generators with capacities to 400,000 lb per hr. Stokers used in the past, including natural draft overfeed, underfeed, forced draft chain and traveling grates, gave good results if properly operated with satisfactory fuels. However, during war periods particularly, suitable fuels for these stokers could not always be obtained and maintenance was high and capacity limited. Readily available cheaper fuels of comparable heating value could not be handled successfully with these old stoker types designed for premium coals. Thus it was quite natural that spreader stokers, developed for fluctuating loads using a wide range of fuel with low maintenance cost and power consumption, should become popular.

Fuels in this country vary widely from 6700 Btu per lb western lignites having 40 per cent moisture and 8500 to 12,000 Btu mid-western high ash coals with ash fusing temperatures from 1900 to 2300 F to high grade eastern bituminous with heat content of 14,000 Btu per lb. To handle any of these fuels called for new type of stoker with variation in furnace design. The spreader stoker has solved the problem in many plants because it was found to burn low quality fuels efficiently.

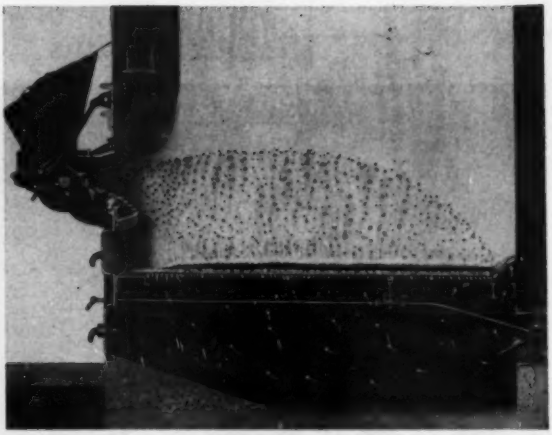
Under present supply conditions, ability to satisfactorily and efficiently burn a wide variety of fuel is important. Average ash fusion temperature is going down steadily as low fusion coals from the eastern fields replace the high fusion coals previously available. Fortunately, all types of bituminous or sub-bituminous coal as well as coke breeze, semi-anthracite, lignite, waste wood and other kinds of refuse can be used with spreader stokers. However, uniform sizing and minimum segregation results in best operation, 1¼ x 0 in. or ¾ x 0 in. with about 50 per cent of fines being the most desirable sizes.

The spreader stoker basically consists of a series of rotating coal feeding units, mounted on the boiler front outside of the furnace, combined with a highly resistant forced draft grate. Coal is projected into the furnace due to impact with blades mounted on revolving rotors resulting in very uniform distribution. Finer particles are burned in suspension while coarser coal forms a thin, porous fuel bed on a horizontal grate without agitation of the fuel bed or ash, a great advantage when burning coals of low ash fusion temperature. Coal burns rapidly with little time for coking, the fuel bed being about equally active over the entire grate with no spots of excessive temperature and remaining porous without fissures or channels.

Continuously moving grates are used for most units of medium and large size, long sustained heavy loads, or burning high ash coals. Movement is slow, a few feet per hour, to insure a constant active combustion area and uniform depth of burning fuel without causing agitation on the grate. This leaves ash, cooled by combustion air passing uniformly through it underneath the thin bed of burning coal, which protects the grates. The ash discharged from the slowly traveling



Dumping grate spreader stokers may be power actuated as shown or manually operated



On units equipped with stationary grates, the ash is removed manually through doors conveniently located at grate level

grate is granular as there is little clinkering tendency even when burning normally clinkering coals and coals with low ash fusion temperature. It may be handled easily by any type of disposal equipment including steam or vacuum conveyers, hydraulic systems, or cars.

With the continuously cleaning type grate, a burning rate of 750,000 Btu per sq ft is suggested as a basis of design for bituminous coals, although higher rates have been obtained. For lignite, a release of 650,000 Btu per sq ft is recommended. Preheated air can be used but the temperature should not exceed 350 F for bituminous coal or 400 F for lignite.

Whenever coal is burned, there is some carryover of combustible and ash particles in the gases of combustion. This is not exclusive with any particular method of coal burning. The amount of this carryover depends upon many factors, such as: (a) coal characteristics, (b) grate proportions, (c) burning rate, (d) type of load, and (e) design of furnace and boiler. Usually the particles are fairly coarse and can be separated effectively by impact, reversal of flow, or centrifugal action in tubes or cyclones, and performance data is generally based on 85 per cent recovery of the solids leaving the boiler.

Many installations are designed to return the greater portion of the separated particles to the furnace. This cinder return and overfire air system requires careful study for proper application so dust loading will be held to a minimum in the boiler and stack gas dust loadings will be within ASME code limits. High pressure fans supply 5 to 15 per cent of the total air required for combustion in conjuction with this system, some of the air being used as a vehicle to convey collected solids while the balance passes through overfire jets located in the furnace.

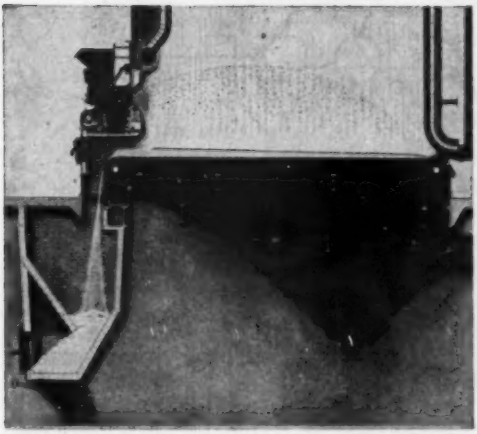
Fly ash return from dust collector hoppers will depend on the number of fractionating points between furnace outlet and dust collector inlet. If the boiler baffle design is such that a reasonable amount of solids can be collected under the boiler and effective skimmer baffles can be installed, it may not pay to return the dust collector catch. However, for single pass boilers or systems where suitable skimmer baffles cannot be installed, it is often advantageous to return cinders from the collector.

Many systems are designed so that collected solids can be bypassed to the ash disposal system if tests reveal there is no economy in returning the collector catch. When particles are reinjected, they are introduced at a point approximately 12 to 20 inches above the grate where the highest temperature exists, distribution being equalized across the furnace as well as physical conditions will permit. The air used in these systems is proportioned to undergrate air.

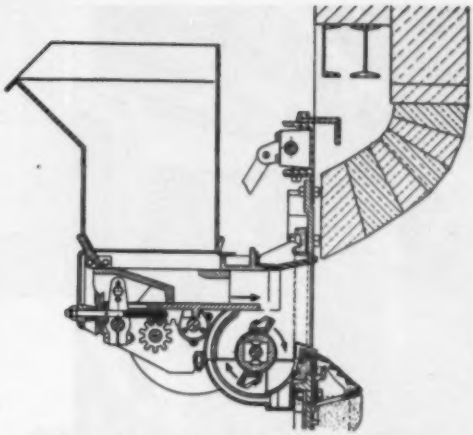
During the past few years, complete test data on cinder recovery has been accumulated that reveals some interesting information. Curves plotted from the test data show dust loading per cubic foot of gas does not increase in proportion to the burning rate. When the burning rate goes up, furnace temperature rises and furnace turbulence becomes much more effective, thereby tending to more completely burn out fly carbon. As a result, the increase in carryover is very negligible.

Additional details indicated by the tests include: (a) efficiency drops from 1 to 3 per cent without total reinjection, (b) reinjection on to the grate considerably reduces recirculation of fly ash, (c) primary low draft loss collectors ahead of the high efficiency collector are desirable, and (d) properly located overfire air nozzles produce necessary furnace turbulence. While considerable data has been accumulated, further

Part of the surface was removed from this continuous discharge grate to show basic construction. Sifting hopper serves as plenum for primary air



With moving grates, ash discharge is continuous which eliminates the need for intermittent cleaning of fires



Rotating feeders receive coal from the hoppers and distribute it uniformly over the entire grate area

development work is being done to improve reinjection systems.

A properly designed furnace is just as necessary for a spreader stoker as for any other type, but it is usually simpler and less costly. Because of the wide range of spreader shapes available, the width and length dimensions are very flexible. While a high rectangular furnace is desirable with black surface 30 to 35 per cent minimum of the total for stationary or dumping grate spreader stokers, completely water cooled furnaces are required for all continuously cleaning stokers. No ignition arches are required inside the furnace walls. In general, a maximum furnace liberation of 30,000 to 35,000 Btu per cu ft of furnace volume is recommended for bituminous coal. All available furnace volume is used effectively as there are no deflecting arches and gas rises uniformly from all portions of the grate area. Furnace design should include means for securing maximum possible turbulence directly above the fuel bed.

Water walls add valuable heating surface, increase radiant heat transfer, lower gas temperatures and protect the refractories. Usually, vertical tubes on the side walls and rear wall spaced on centers not exceeding twice the tube diameter, are found sufficient and satisfactory. The stoker operating mechanism extends only a few feet beyond the boiler front line permitting installation in a compact space.

Slagging across the first bank of boiler tubes and plugging of the first pass and superheater seldom occurs with a properly designed spreader stoker. There is no possibility of blasting through the fuel bed as resistance is always low and grate surface is highly restricted. This combination pre-

TABLE 1—MAINTENANCE COST RECORD FOR TYPICAL SPREADER STOKER INSTALLATION

Number of hours in service	37,846
Tons of coal burned on grate	285,405
Total cost of grate maintenance for service hours	1201.49
Total cost of spreader maintenance for service hours	1500.00
Cost of grate maintenance per ton of coal burned in mills	4.22
Cost of stoker maintenance per ton of coal burned in mills	5.26
Total cost in mills	9.48

TABLE 2—POWER CONSUMPTION DATA FROM STATION TEST REPORT

Load in lb of steam per hr	50,000	100,000	125,000	150,000
Power for FD fan in kw hr	30	37	48	56
Power for ID fan in kw hr	92	115	134	147
Power for stoker drive & auxiliary fan in kw hr	17	19	20	21
Lb of coal burned per hr	5392	10,615	12,883	15,612
Tons of coal burned per hr	2.696	5.307	6.441	7.806
Power for FD fan in kw hr per ton	11.17	6.98	7.45	7.18
Power for ID fan in kw hr per ton	34.15	21.70	20.80	18.85
Power for stoker drive & auxiliary fan in kw per ton	6.32	3.58	3.10	2.69
Total auxiliary power in kw hr per ton	51.64	32.26	31.35	28.72

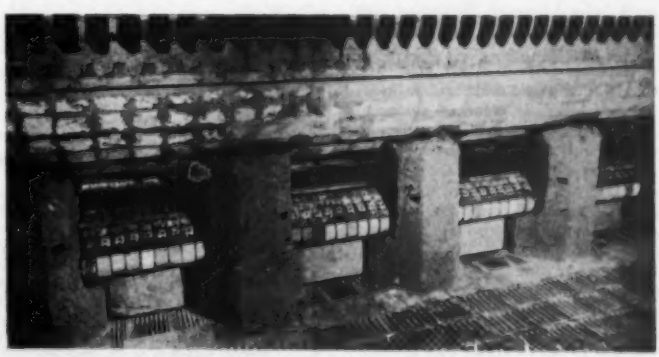
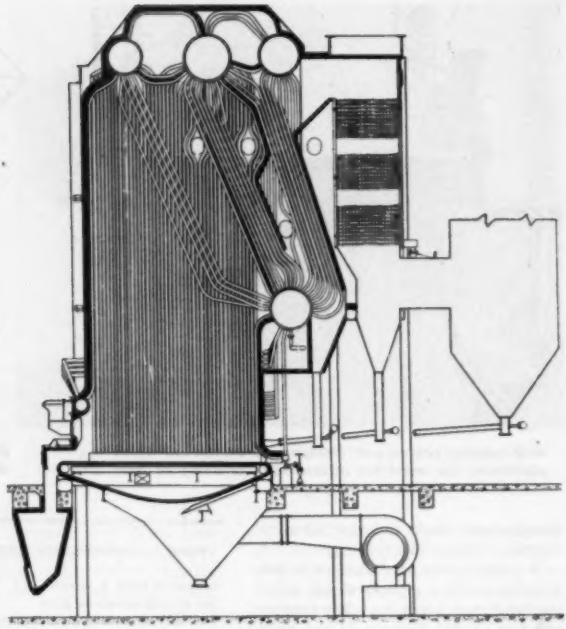


Photo shows feeder assembly for spreader stoker with power dumping grate installed in a steam generator having a water cooled front furnace wall

Power dumping stoker on the right hand unit is equipped with both auxiliary turbine and motor drives to guarantee service continuity



Some installations are designed to reinject all separated particles from the last pass of the boiler, economizer and cinder separator

vents development of high velocity, high temperature channels which occur frequently in heavy mass stoker fuel beds. When burning coals with low ash fusion temperature, there is little likelihood of molten ash particles being carried into tube banks.

Many operators report maintenance costs of stoker equipment including parts and labor are not more than one cent per ton of coal burned. One large midwestern industrial plant furnished the information shown in Table 1. The figures are for a spreader stoker serving a 210,000 lb per hr steam generator and cover a period from November 1940 to May 1946. The same plant reports a total of 407,980 tons of coal were burned between November 1940 and December 1948, at a maintenance cost of one cent per ton. Also, outside of the replacement of six grate bars, the original grates were still in use.

Availability is another important item for consideration among leading utility and industrial power plants. Records are available that show no outages due to stoker failures, the stokers having operated continuously for a year or more, only coming down for annual inspections.

Power requirements for driving spreader stokers are considerably less than those needed for pulverized coal firing. A typical spreader serving a 150,000 lb per hr boiler uses approximately 5 hp for driving the stoker motor, 5 hp for the front wall air cooling motor and 30 hp for the overfire air and cinder return fan motors. This is a total of 40 hp which is equivalent to 0.266 hp per 1000 lb of steam.

An Eastern Ohio utility provided the rates of power consumption at various loads shown in Table 2. The stoker serves a steam generator having a continuous duty rating of only 125,000 lb per hr at 225 psig 575 F based on 210 F feedwater but the unit has generated over 150,000 lb per hr. Fuel burned is Duncanwood Mine Ohio bituminous coal with analysis as follows:

Btu per lb as fired	11,720
Ash fusion temperature deg F	2100
Per cent moisture	6.8
Per cent volatile matter	33.5
Per cent fixed carbon	47.2
Per cent ash	12.5
Per cent sulfur—separately determined	2.5

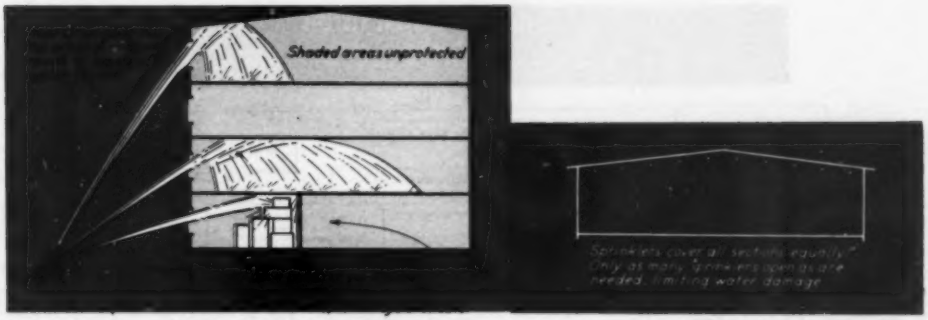
The cost of power varies considerably in different plants and, therefore, the expense of operating the stoker drive and associated auxiliary fans cannot be predicted. However, it can be noted that at the guaranteed capacity of 125,000 lb of steam per hr with a coal consumption of 6.441 tons per hr, the power used was 3.1 kw hr per ton.

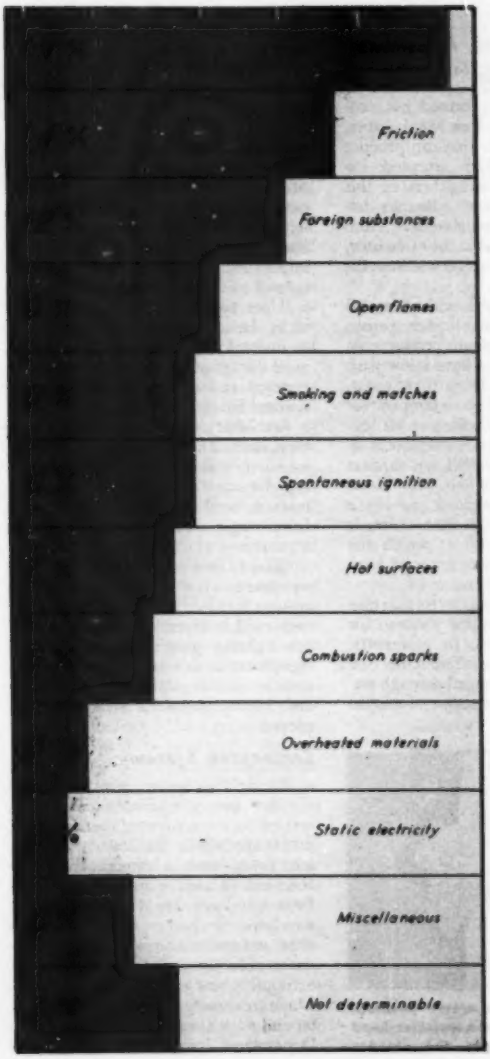
Some of the major reasons for the increasing respect for spreader stoker firing are shown in Table 3. While the factors presented apply primarily to units burning coal, many installations are using spreaders for firing a wide variety of solid refuse material. This situation is due to the inherent design feature of spreader stokers which permits burning a portion of the fuel on a thin active bed and the balance in suspension.

The material in this article was abstracted from a paper presented by the author at the Fall Meeting of the Prime Movers Committee of the Pennsylvania Electric Association in Johnston, Pennsylvania on Nov. 1, 1951.

TABLE 3—IMPORTANT FEATURES OF SPREADER STOKER FIRING

1. All types of solid fuel that are available in quantity can be burned efficiently.
2. Power consumption of stoker and associated auxiliaries is low.
3. Clinkering is negligible where stoker and furnaces are designed properly.
4. Maintenance costs are low, often averaging about one cent per ton of coal burned.
5. Space around the boiler is comparatively free of equipment.
6. Main ash is very granular and handles easily (highly suitable for cinder block).
7. Stoker operates well with preheated air up to 350 F with bituminous coal.
8. Unit meets rapid load changes with little change in pressure or efficiency.
9. Spreaders can be held on a dead or live bank, and brought up to full load as fast as the physical conditions of the steam generator will permit.
10. No auxiliary fuel is required to meet light loads or for lighting off.





ENGINEERED FIRE FIGHTING SYSTEMS

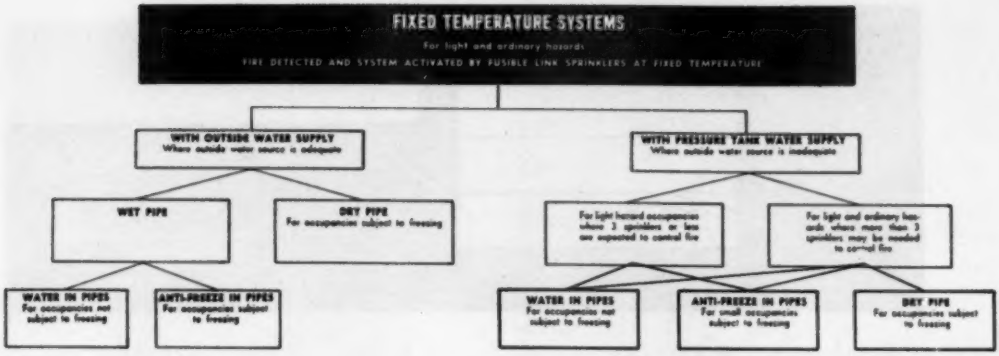
For years management has installed fire fighting equipment for the sole purpose of reducing insurance premiums. Now management has awakened to the fact that a production outage caused by fire can be and is expensive.

With this thought in mind fire fighting systems are being engineered and selected, not with the idea of the insurance aspect, but with the assurance that the best possible protection will be provided. A good example of this is the installation of an engineered fire fighting system in a southern paper mill.

One particular machine, in the paper processing, was valued at $2400 per day from a production standpoint. The machine was also a fire hazard, and outage for this reason was high. A water spray system was installed that operated at the slighest abnormal rise in temperature. So far this system has prevented several possible outages by extinguishing fires before they could result in serious damage.

Engineered fire fighting systems strike at the seat of trouble and reduce human element to the minimum. The more extensive equipment warns of a fire, and hand equipment can be brought into play in most instances. This report will help those responsible for the selection of such equipment in deciding the proper approach to this problem.

R. A. MOLLER, *Associate Editor*


FIXED TEMPERATURE SYSTEMS
For light and ordinary hazards
FIRE DETECTED AND SYSTEM ACTIVATED BY FUSIBLE LINK SPRINKLERS AT FIXED TEMPERATURE
WITH OUTSIDE WATER SUPPLY
Where outside water source is adequate
WITH PRESSURE TANK WATER SUPPLY
Where outside water source is inadequate
WET PIPE
DRY PIPE
For occupancies subject to freezing
For light hazard occupancies where 3 sprinklers or less are expected to control fire
For light and ordinary hazards where more than 3 sprinklers may be needed to control fire
WATER IN PIPES
For occupancies not subject to freezing
ANTI-FREEZE IN PIPES
For occupancies subject to freezing
WATER IN PIPES
For occupancies not subject to freezing
ANTI-FREEZE IN PIPES
For small occupancies subject to freezing
DRY PIPE
For occupancies subject to freezing

Fixed temperature fire fighting systems can have either a wet or dry pipe. The system is so called as it is actuated by the melting of fusable link sprinklers set to open at fixed temperatures

FIRE, industry's worst enemy, cannot be fully eliminated. But, by properly engineered fire fighting equipment the loss of property and plant production outage can be substantially reduced. Causes of fire are numerous, some can be avoided by constant inspection and inaugurating a safety program within the plant. The old adage "an ounce of prevention is worth more than a pound of cure", still holds true. But, a fire, when apprehended in time, can be retarded and extinguished with little or no damage.

Primarily, a fire consists of three elements: fuel, heat and oxygen. By reducing or eliminating one or more of these, the fire can be halted. Actually solids and liquids do not burn. Intense heat liberates combustible vapors from a burnable substance that unite with oxygen to form a flame and additional heat. The process is continuous until the fuel, oxygen or heat is removed.

Removal of the fuel is very unlikely unless as in the case of flammable liquid spill or gas leaks a valve may be closed. But, removing heat and displacing the oxygen may be readily accomplished. Furthermore, the method of extinguishment employed depends upon the type and class of the fire. Fires are divided into three broad classifications: Classes A, B and C.

Fire Classification

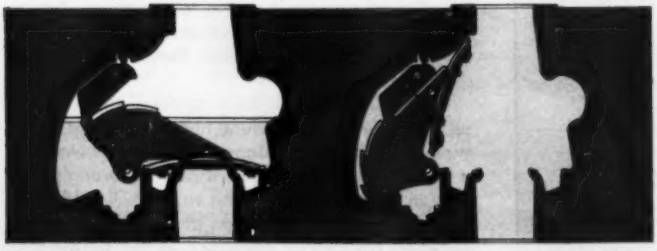
Class A fires are formed by combustible materials such as wood, paper, coal, and other solids that can produce burning embers. The accepted extinguisher for combating fires of this nature is water. Water, either in deluge or water spray, removes heat from the burning mass, and at the same time, dilutes the necessary oxygen to support combustion.

Materials associated with Class B fires include flammable liquids, paints, greases and all petroleum products. In general these products have a low flash point and are less dense than water. Flash point is the lowest temperature at which a substance will give off sufficient vapor to form a flammable mixture with oxygen but will not support its own combustion when a test flame is removed. The fire point, usually a few degrees above the flash point, is the lowest temperature at which the flammable liquid will continue to burn after the test flame is removed.

Exclusion of oxygen, by blanketing or smothering, is the best defense for fighting Class B fires. In past years, CO_2 and foams have offered the best solution. Water discharged through water spray nozzles has been employed quite effectively to reduce surface temperature of the flammable material and of the products of combustion. Carbon dioxide, when sprayed upon a fire, tends to reduce the temperature of the liquid below its flash point. At the same time, oxygen is displaced and diluted to the point where combustion will not be supported. It is necessary, as in the use of foam or water spray, to maintain the concentration of CO_2 until the temperatures of the flammable material and of the surroundings are reduced below the flash point.

Combinations of CO_2 and foam have been used. The CO_2 vapor almost immediately extinguishes the fire by diluting the oxygen. A layer of foam follows to seal the flammable surface from oxygen and to prevent the escape of vapor.

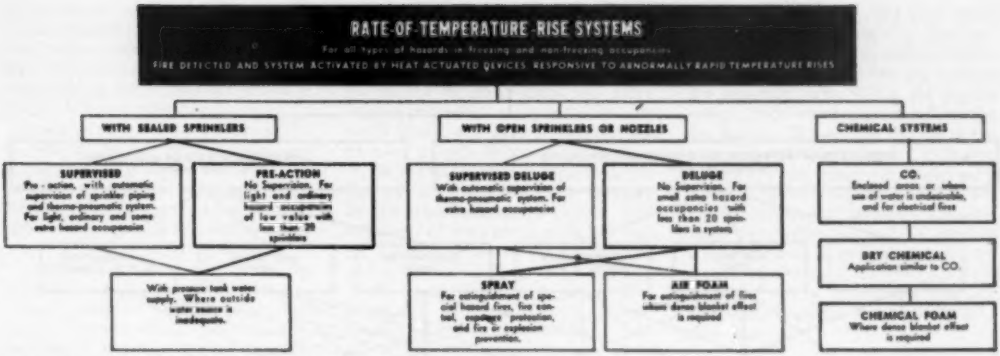
Class C fires pertain to all electrical equipment where the presence of high voltage may add to the hazards of fire extinguishment in order that neither fire fighting personnel nor electrical equipment is injured. For this reason carbon dioxide, carbon tetrachloride, and highly atomized water are employed.



This type of valve is installed in a dry type sprinkler system. Air, under pressure in the piping system, acts to hold the clapper in a closed position. Release of the air at the sprinkler head immediately disengages the clapper

Engineered Systems

Fire fighting systems may be planned so that the extinguishing medium is carried to the source of the fire. Four media applied in this manner are water, foam, carbon dioxide, and dry chemical. Water is furnished directly from city mains or from an inplant standpipe or pump. City mains are sized and interconnected to deliver adequate volumes and pressures for the extinguishment of any anticipated fire. These are usually 6 in. or greater diameter and must also serve anticipated Fire Department demands through yard or


RATE-OF-TEMPERATURE-RISE SYSTEMS
For all types of hazards in freezing and non-freezing occupancies
FIRE DETECTED AND SYSTEM ACTIVATED BY HEAT ACTUATED DEVICES RESPONSIVE TO ABNORMALLY RAPID TEMPERATURE RISES
WITH SEALED SPRINKLERS
WITH OPEN SPRINKLERS OR NOZZLES
CHEMICAL SYSTEMS
SUPERVISED
Pre-action, with automatic supervision of sprinkler piping and thermo-pneumatic system. For light, ordinary and some extra hazard occupancies
PRE-ACTION
No Supervision. For light and ordinary hazard occupancies of low value with less than 20 sprinklers
With pressure tank water supply. Where outside water source is inadequate.
SUPERVISED DELUGE
With automatic supervision of thermo-pneumatic system. For extra hazard occupancies
DELUGE
No Supervision. For small extra hazard occupancies with less than 20 sprinklers in system
SPRAY
For extinguishment of special hazard fires, fire control, explosion protection, and fire or explosion prevention.
AIR FOAM
For extinguishment of fires where dense blanket effect is required
CO2
Enclosed areas or where use of water is undesirable, and for electrical fires
DRY CHEMICAL
Application similar to CO2
CHEMICAL FOAM
Where dense blanket effect is required

Rate-of-temperature-rise detection is adaptable for both the wet and dry pipe sprinkler systems. A heat actuating device feels an abnormal rise in temperature and causes an alarm to operate

street hydrants. City main pressure may be increased by provision for fire department connection or supplemented by some other auxiliary water supply.

Where water rates are high, or where extending pipe lines would make the installation cost prohibitive, limited water supply is possible through pressure tanks. The pressure tank system is filled from the normal water piping system in the hazard area, and the tank is pressurized with air or nitrogen. This arrangement is termed a "one shot" system as all the water is discharged at one time. This type of system is generally installed where the hazard is of a limited nature.

Foam, which is 5 to 10 times lighter than water, employs water as its basic component while air or carbon dioxide is held by a stabilizer in the form of small bubbles. The water may be derived as outlined above and stabilizer may be inducted with the fire stream or may be premixed and stored as in a pressure vessel. Air is usually inducted at the foam applicator while carbon dioxide is produced by chemical reaction within the solution formed by water and stabilizer. The engineered system automatically produces, conducts, and applies foam as a floating blanket over flammable liquid surfaces or as an insulator to surfaces exposed to heat from fire.

Carbon dioxide, which obtains its extinguishing action through dilution of flammable vapor mixture and by its cooling action, is held ready for application by a system of storage tanks, automatic valves, and applicators. Pressure vessels are designed to store the carbon dioxide in either a liquid or gaseous state. Automatic refrigeration is necessary to maintain the liquid state and as a result, weight of container is not so high because of the accompanying lower pressures.

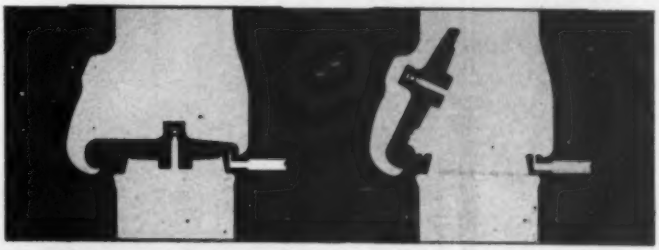
Dry chemical systems employ bicarbonate of soda in a finely divided state and mixed with an anti-caking material. Nitrogen is used to carry the dry chemical through piping systems to applicators. These new automatic systems have been found to be particularly valuable protection for many hazards where water, foam or carbon dioxide is not entirely adequate.

Water has been the most widely employed medium for extinguishing fires, presumably because of its cooling effect and availability. Generally water, as utilized in retarding a fire, has a temperature of about 60 F, and the amount of heat absorbed while vaporizing a gallon of fluid is quite high. Four general types of sprinkler systems are available for distributing water to burning areas. These are the so-called wet pipe, dry pipe, preaction, and deluge sprinkler systems. Three of these systems have sprinkler heads that are ruptured at a fixed temperature while the deluge sprinkler system is equipped with open nozzles. A local or remote fire alarm is actuated while water is being discharged.

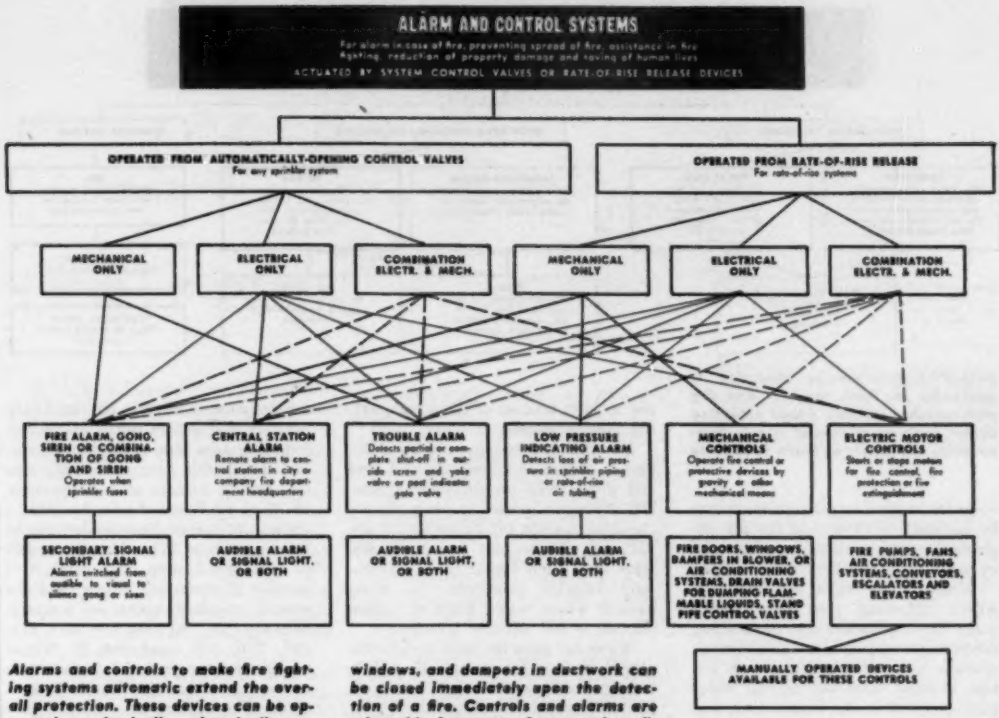
Generally, the so-called wet and dry pipe sprinkler systems are referred to as fixed temperature systems. Sprinklers are designed to open at the fixed temperature that is best suited to the surrounding area. For example, the normal installation, such as an office area may have a constant room temperature of 70 to 80 F and the fusible link, a component part of the sprinkler, may be set to operate at 135, 150, 160, or 165 F. Sprinkler fusible links come in a number of operating ranges, and the general standard operating temperatures are 135, 150, 160, 165, 175, 212, 250, 286, 325, and 360 F. Where average area temperature is higher, such as over an oven, the fusible link is specified to operate at a much higher temperature.

Dry Pipe Systems

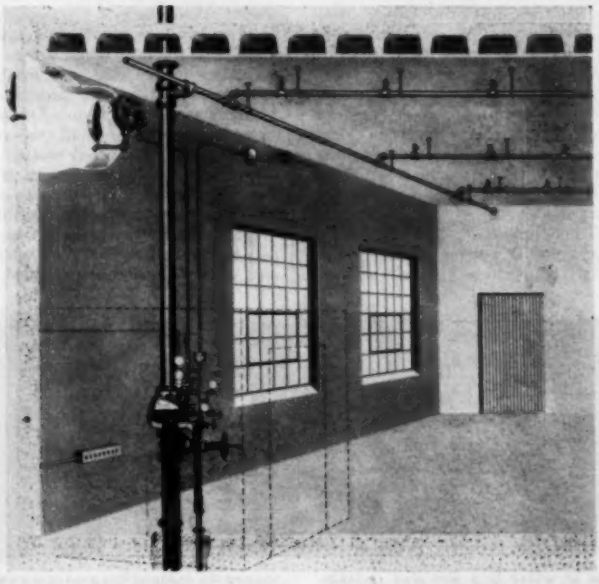
Dry pipe sprinkler systems are installed where there is a possibility of freezing weather or in cold storage areas. The piping, which serves the sprinklers in the cold area, contains only compressed air or an inert gas such as nitrogen. When a fusible link separates in a sprinkler head, the compressed air in the pipeline escapes and allows a dry-pipe valve, which is located in a heated valve house, to open and admit water to the sprinkler lines. Water immediately fills the piping system and discharges upon the affected area while a fire alarm is sounded.



Flow of water in a wet pipe sprinkler system is controlled through a special check valve. When a sprinkler head is opened the reduced line pressure causes the clapper to rise exposing an opening leading to a hydraulic operated alarm


ALARM AND CONTROL SYSTEMS
For alarm in case of fire, preventing spread of fire, assistance in fire fighting, reduction of property damage and saving of human lives
ACTUATED BY SYSTEM CONTROL VALVES OR RATE-OF-RISE RELEASE DEVICES
OPERATED FROM AUTOMATICALLY-OPENING CONTROL VALVES
For any sprinkler system
OPERATED FROM RATE-OF-RISE RELEASE
For rate-of-rise systems
MECHANICAL ONLY
ELECTRICAL ONLY
COMBINATION ELECTR. & MECH.
MECHANICAL ONLY
ELECTRICAL ONLY
COMBINATION ELECTR. & MECH.
FIRE ALARM, GONG, SIREN OR COMBINATION OF GONG AND SIREN
Operates when sprinkler fuses
CENTRAL STATION ALARM
Remote alarm to central station in city or company fire department headquarters
TROUBLE ALARM
Detects partial or complete shut-off in outside screw and yoke valve or post indicator gate valve
LOW PRESSURE INDICATING ALARM
Detects loss of air pressure in sprinkler piping or rate-of-rise air tubing
MECHANICAL CONTROLS
Operate fire control or protective devices by gravity or other mechanical means
ELECTRIC MOTOR CONTROLS
Starts or stops motors for fire control, fire protection or fire extinguishment
SECONDARY SIGNAL LIGHT ALARM
Alarm switched from audible to visual to silence gong or siren
AUDIBLE ALARM OR SIGNAL LIGHT, OR BOTH
AUDIBLE ALARM OR SIGNAL LIGHT, OR BOTH
AUDIBLE ALARM OR SIGNAL LIGHT, OR BOTH
FIRE DOORS, WINDOWS, DAMPERS IN BLOWER, OR AIR CONDITIONING SYSTEMS, DRAIN VALVES FOR DUMPING FLAMMABLE LIQUIDS, STAND PIPE CONTROL VALVES
FIRE PUMPS, FANS, AIR CONDITIONING SYSTEMS, CONVEYORS, ESCALATORS AND ELEVATORS
MANUALLY OPERATED DEVICES AVAILABLE FOR THESE CONTROLS

Alarms and controls to make fire fighting systems automatic extend the overall protection. These devices can be operated mechanically, electrically, or in a combination of both. Fire doors, windows, and dampers in ductwork can be closed immediately upon the detection of a fire. Controls and alarms are adaptable for water, foam, carbon dioxide, and chemical fire fighting systems



Piping in the dry pipe system is filled with air or nitrogen under pressure. The system is actuated when a fusable link melts allowing the gas to escape

Principal components of the dry system consist of engineered pipe lines, dry pipe valve, accelerator or quick opening device, compressed air source for the piping system, fusible link sprinklers, and water motor alarm system. Dry pipe valves that control the entry of water into this type of system generally have a minimum of moving parts. A pivoting clapper is designed to give a differential ratio of 6 to 1. With this ratio 15 psi air would be sufficient to hold back water at 90 psi.

As air is released, due to the opening of an automatic sprinkler, the ratio of water pressure to air pressure exceeds the 6 to 1 ratio. With the reduction of air pressure, the water, under pressure, lifts the clapper, locking it in its open position and permits a full flow to the sprinkler. With the continued flow of water through the valve, a hydraulic motor is actuated that can sound an audible alarm. Water flow from opened sprinklers can be stopped by closing the main water valve and opening the sprinkler system drain valves. When the system has been drained and the clapper is reset, the sprinkler head or heads are replaced and air pumped into the pipe.

When the air pressure has reached a value sufficient to offset the water pressure with a sufficient factor of safety, water valve is opened, fire alarm and water supply tested, and the system is ready for future operation.

Location of dry pipe valves should be as near to the base of the main riser as practicable. An enclosure is generally provided around this valve to prevent freezing. Temperatures are maintained above freezing with the utilization of electrical heaters or steam coils.

Compressed air supply should be available at all times either from a specially installed compressor or plant supply. Capacity of the system must be capable of restoring normal air pressure, plus 25 per cent, within a period of 30 min. The compressor, when installed for this purpose, can be located wherever desired, but preferably near the dry pipe valve or valves.

For the system to operate properly the air intake for the installed compressor should be located so as to obtain clean, dry, and cold air. The intake should be properly protected with filters and all dust particles screened out completely. The purpose of this arrangement is to minimize trouble from condensation in the air piping and sprinkler system.

Compressed air usually enters the system at the dry pipe valve, at a level above the priming water. When a separate air compressor is installed the air line should be provided with a check and control valve of renewable disc type. When the air source is from the plant system, normally at a greater pressure than necessary, an additional control or pressure reduction valve should be provided in the air line.

Generally, high air pressure in dry pipe systems is undesirable as tripping of the dry pipe valve is retarded. In the older, more common type, pressure should not be more than 15 to 20 psi in excess of normal air tripping pressure. In the newer low pressure dry pipe sprinkler systems the air pressure is automatically maintained between 6 and 8 psi.

Wet Pipe Systems

Where temperatures in protected areas remain above freezing the wet pipe system takes preference over the dry pipe as water is immediately available at the sprinkler head at all times. As in the dry pipe system, the piping is graduated and decreases in diameter until it reaches the outermost sprinkler head. This procedure assures adequate water pressure at every sprinkler head.

Should a fire occur, the increased temperature causes the fusible link in the sprinkler head to separate, releasing water for extinguishment. Only the sprinklers affected will discharge water. This, as in the dry pipe system, reduces water damage to an absolute minimum.

An alarm check valve is installed in the riser of the water main. This valve is equipped with a clapper that is normally closed and held in position by its own weight. When a fusible link in the sprinkler head is separated, the flow of water will reduce the pressure on the upper side of the clapper. The reduction of pressure permits the water pressure below to lift the clapper and a pilot valve. A very small portion of the water flowing to the opened sprinklers is diverted through the opened pilot valve to a hydraulic motor, which can operate an alarm, or to pressure switch and electrical controls to make or break the circuit to electrical equipment.

After a fire has been extinguished the master water valve preceding the alarm valve is turned off and the system drained. The sprinkler heads are replaced and the master valve is then turned on, filling the system. A water flow test and alarm test are then conducted to make certain that the sprinkler system is in first class condition.

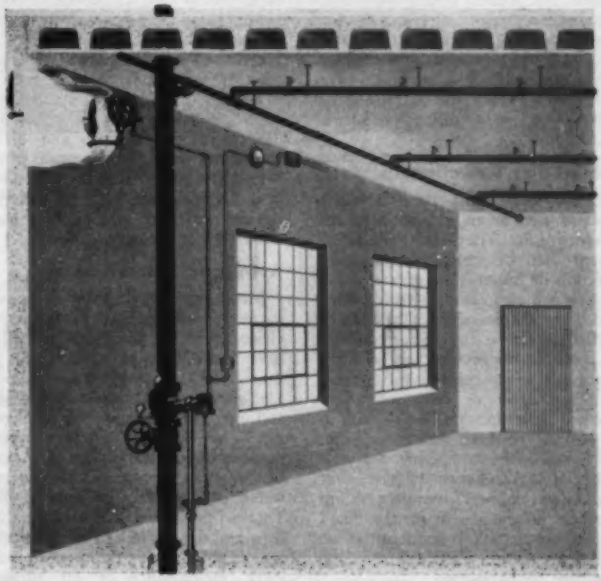
Preaction Sprinkler Systems

Ultimate in automatic sprinkler equipment is obtained by combining the fixed temperature method of fire detection, the rate-of-temperature-rise method of fire detection, with an empty pipe sprinkler system. The very sensitive rate-of-temperature-rise heat actuated devices (HAD's) respond to fire in the incipient stages and act to open the preaction valve filling the piping system with water and sounding the fire alarm. Action can be taken to manually extinguish the fire with first aid equipment while the same early warning allows occupants of the building to evacuate and automatically summons fire department aid. If the fire is extinguished in this early stage, operation of automatic sprinkler's fusible links will not be caused and both fire and water damage will be held at a minimum.

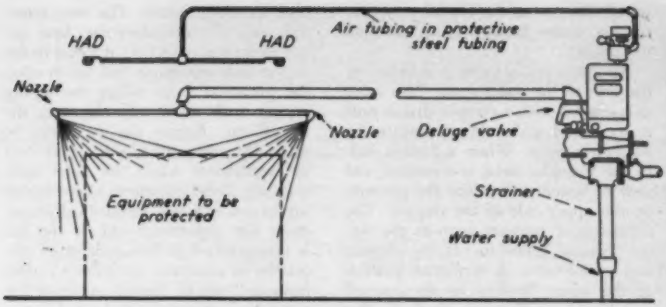
Deluge Sprinkler Systems

Rate-of-temperature-rise sensitive fire detection system is also employed in areas and in processes where highly flammable materials are present. The deluge sprinkler system is usually equipped to discharge water over the entire area from open spray nozzles or from sprinklers without fusible elements. Detection of fire in an area or process is as rapid at –60 F as it is at 150 F and the rate-of-temperature-rise is used to trigger the deluge valve and to cause discharge of water from all sprinklers or spray nozzles in the area.

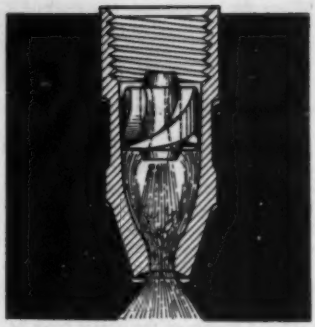
Water supply requirements for deluge sprinkler systems are much more severe since it must be expected that all sprinklers or spray nozzles will be dis-



In the wet pipe system, the piping contains water at all times. Heat from a fire melts the fusable link in a sprinkler head to actuate the flow of water



Spray or fog type systems have open nozzles and a dry pipe. When a heat actuating device feels an abnormal rise in temperature a deluge valve is opened, flooding the fire area. The system is closed manually after fire is out



This special spray nozzle atomizes the water as it is discharged to produce a good cooling effect and quick quenching

charging. (An average of three sprinklers is expected to operate in occupancies of light or moderate hazard where wet and dry pipe sprinkler systems will be found.)

Since water from deluge sprinkler systems may be used in one or a combination of ways to provide fire protection, much consideration has to be given to the placement of nozzles around the hazardous area. It has been found necessary, for example, to completely blanket all surfaces of a vessel containing high vapor-pressure flammable liquids with at least ¼ gpm of water on each square foot in order that relief capacity of safety vents and strength of container are not overcome during an exposure fire. Other nozzle placement techniques are found necessary to completely extinguish some flammable materials where it is found desirable to only control burning rate of others since their vapors must be consumed as emitted even at atmospheric temperatures.

Rate-of-Rise Detection

Rate-of-temperature-rise of air in a room is used as an indication of the presence of fire. The thermal-pneumatic system used by many for the rapid detection of fire consists of a vessel—the heat actuated device—that converts heat into air pressure, a system of small bore copper tubing for conducting pressure changes to a very sensitive diaphragm and compensating vent. Abnormal rates of temperature increase produce pressure change rates in air within the heat actuated device, which cannot be compensated at the calibrated vent and cause the movement of the diaphragm. This system of fire detection as compared to the fixed temperature system is as sensitive at cold storage-vault temperatures as at bake-oven temperatures.

Adjustment of sensitivity is accomplished by selection of proper compensating vent capacity and by altering the pressure-travel characteristic of the diaphragm. Care must be exercised in selection of these components that adequate sensitivity is secured while unnecessary sensitivity is not obtained; false operation may result. When as occasionally in the case of a bake oven, the warm up rate is too rapid. A compensating vent may not bleed normal pressure increases, and at the same time restrict the loss of pressure when actual fire temperatures occur. Then a change in the method of process operation should be considered, along with installing special automatic equipment to temporarily desensitize the fire detection system while in certain phases of a process cycle. Each fire detection system should be tailored to its normal surroundings.

Sufficient displacement of the diaphragm disengages a series of lever-escapements to allow the dropping of at least 50 lb of weight. In addition to the control of preaction and deluge sprinkler systems, these systems of fire detection automatically close fire doors, open dump valves, shut off electrical devices, start fire pumps, and many other jobs at the time of fire.

Automatic Supervision

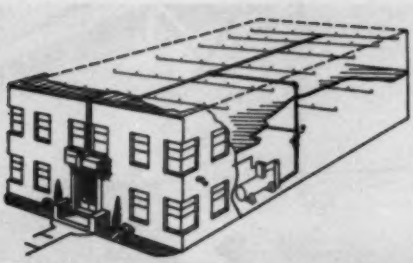
Mechanical or electrical equipment is just as dependable as the supervision. Closed main control valves have contributed to almost 100 per cent of all failures of automatic sprinkler systems at the time of fire. OS&Y and indicator post valves may be supervised by electrical switches which, through trouble alarm circuits, indicate full opening through which adequate water is available for fighting fire. Thermal-pneumatic fire detection systems and dry sprinkler piping are continuously tested for tightness by automatic maintenance of air pressure slightly in excess of atmospheric pressure. Electrical circuit continuity is automatically tested and failures, whether because of broken or grounded conductors, are reported.

Water Spray or Fog

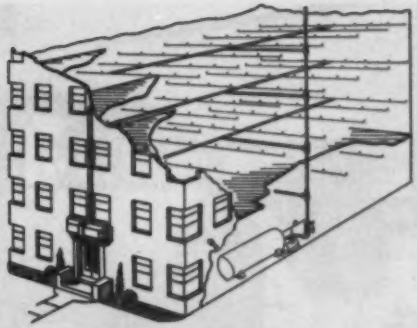
Deluge systems are sometimes fitted with special type nozzles that atomize the water upon discharge. The atomized water is directed to effectively extinguish or control burning rate or to protect objects from radiated heat. Finely atomized water vaporizes more readily than does water from ordinary sprinklers, and for this reason the amount of heat absorbed is considerably greater. The fine atomization of the spray is not as conductive to electricity as a full heavy stream of water from the usual type nozzle, and it finds valuable application, for this reason, in the protection of high voltage transformers, switchgear, and rotating electric machinery.

Extinguishment of flammable liquid fires by water spray or fog may be explained by considering the heat absorbing capacity, and the dilution capacity and velocity of the water droplets. The ability to extinguish fires with water spray or fog depends, too, on the characteristics of the fuel being consumed. Easy extinguishment can be realized when the liquid-fuel flash point is greater than 100 F, and when the emulsion capabilities with water are high. These liquid fuel characteristics make possible the reduction of fuel vaporization rates and, as a consequence, early extinguishment.

Many liquid fuels with vaporization rates at ordinary room temperatures are high and where vapor densities are greater than air must be specially protected. Ruptured lines or tanks of these liquid fuels, which are ignited, must be protected from complete destruction while controlling valves or processes are used to stop flow. Reducing burning rate is desirable, but extinguishment is not accomplished until



When water is at a premium or the main leading into the building or plant is too small to carry enough water, a pressurized storage tank can be installed



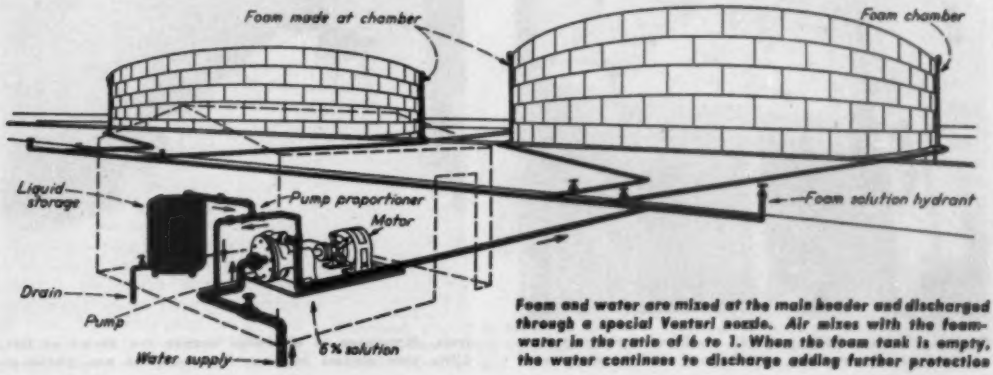
System at left is operated as a simple fixed temperature unit, while the one on the right can be controlled with a rate-of-rise heat actuating device

fuel flow is stopped. Continued production of heavy vapors after extinguishment will result in a reflash at a point remote from the originally involved area, and explosive damage might destroy other buildings and occupants.

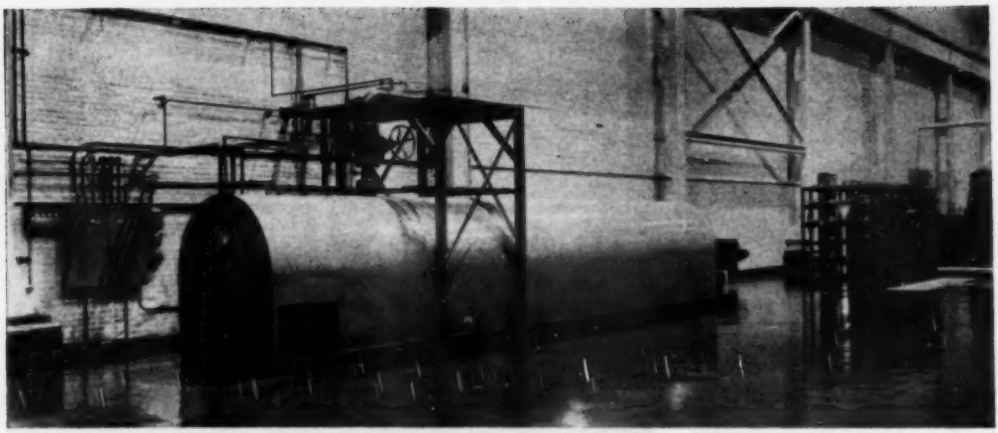
Air Foam Systems

Another extinguishing agent controlled by the supervised deluge system is air foam. Fires are extinguished by smothering, cooling, and sealing flammable surfaces. Foam has a decided advantage over water in fighting certain fires of highly flammable, low flash point liquids, which resist extinguishment by cooling, and where low specific gravity liquids would float on water. A liquid stabilizer is added to the fire protection water to produce a long lasting foam. This stabilizer is produced from the protein of the soy bean, fish scale, or blood. This foam liquid is automatically added to water to produce a 3 or 6 per cent solution (depending on the type of liquid used). The foam liquid is stored in a tank and may be injected into the fire stream by

Liquid foam is stored at a central location or near the fire hazard when only one area is to be protected. Principal components located at tank are: foam injection pump, mixing header, and automatically controlled zone valves



Foam and water are mixed at the main header and discharged through a special Venturi nozzle. Air mixes with the foam-water in the ratio of 6 to 1. When the foam tank is empty, the water continues to discharge adding further protection



Low pressure carbon dioxide is stored in one large tank and refrigeration so as to maintain a constant 300 psi pressure

The fire fighting system has a dry pipe, and flow is controlled to fire areas by electrical heat actuating devices

a pump. Ratio of volume of foam liquid to water is regulated by a fixed orifice plate, which is carefully calculated from water supply and solution demand data.

Foam solution, which is automatically produced and admitted to deluge system piping, is discharged into foam making nozzles. Air is inducted in these nozzles through Venturi action and the foam discharged into the fire area. Foam nozzles are used to protect the interior of buildings, storage tanks, and to give good water protection to roof structures after the foam liquid has been exhausted.

Carbon Dioxide

Carbon dioxide is available for fighting fires of all three classes. There are two general types—high pressure and low pressure. The low pressure system has refrigeration so that the CO_2 temperature is held at zero degree and 300 psi pressure. The high pressure system obtains its name inasmuch as the CO_2 is held in containers at room temperature, and a pressure corresponding to this temperature is about 1000 psi.

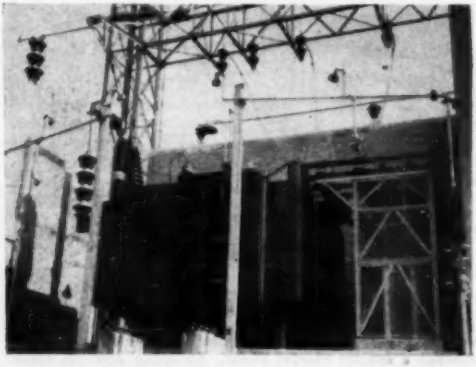
One advantage of the low pressure system over the high pressure is a centrally located storage tank, which can hold as much as two ton of CO_2. Centrally located high pressure systems are made up of multiple small tanks manifolded into one header.

Piping system and arrangement for both methods are comparable to the supervised deluge system in the water sprinkler system. A heat actuated device, either pneumatic or electrical, controls valve operation at the CO_2 storage. Special nozzles directed at hazardous areas are of the open type. Basic controls for both high pressure and low pressure systems are similar. Branch lines, in the low pressure system, are controlled with solenoid valves that are in a normally closed position until the HAD indicator detects an abnormal temperature rise.

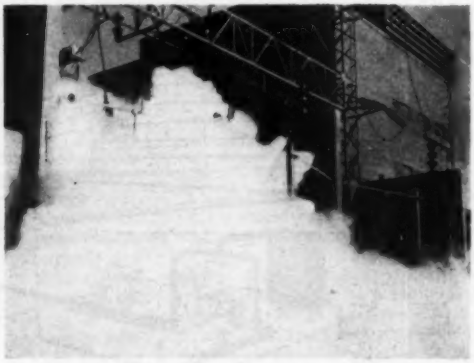
High Pressure Systems

In the high pressure system one or more cylinders are filled with liquid carbon dioxide under pressure. A discharge head is attached to each cylinder that is connected to a main header. Release of the system permits the liquid CO_2 to be discharged through the piping system terminating at the discharge nozzle.

Cylinders can be arranged so that one or more can be tied into a definite area, and will only operate when there is an existing hazard in that location.



Carbon dioxide readily protects electrical equipment such as transformers, motors, switch gear, and auxiliary con-



trols. Placement of discharge nozzles are shown at left. Little time elapses between fire detection and discharge

Low Pressure CO_2

In the low pressure CO_2 engineered fire fighting system liquid carbon dioxide is stored in a single mechanically refrigerated pressure vessel. Temperatures are controlled at approximately zero F, which corresponds to a relatively low pressure of 300 psi. The distribution system to the hazardous areas is comparable to the high pressure system, and controls along with auxiliary equipment are identical.

Carbon dioxide, as an extinguisher, has the advantage over water or foam in that there is no particular mess after the fire has been extinguished. Application of carbon dioxide is in special hazards such as transformers, spray booths, quench tanks and flammable liquid storage. Extra cost for maintaining a full supply of carbon dioxide, obviously, is greater than maintaining the supply of water. However, where such a hazard exists it is well to install the most efficient system.

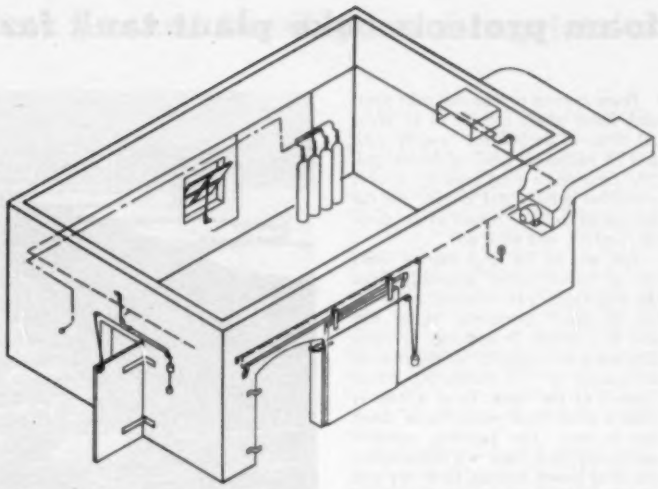
Dry Chemicals

Dry chemical, distributed through piping from a centrally located steel tank that is pressurized with nitrogen gas, is being utilized to extinguish fires. These systems can be automatically controlled with heat actuated devices or thermal retard units when placed in areas of frequent overheating. The piping is comparable to the supervised preaction system installed for water and air foam. Nozzles at the hazard zone are capped with covers that are blown off when pressure builds up by the discharging chemical.

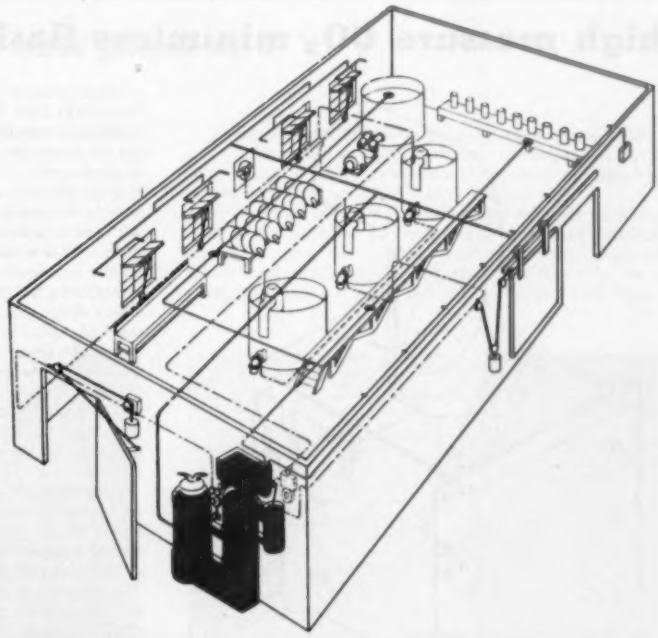
Principal components are the dry chemical tank, nitrogen cylinder and release mechanism, pressure regulator, and bursting disc holder assembled as one complete unit. The tank is tested for 500 psi, but the dry chemical is stored at atmospheric pressure conditions. However, as the system operates, nitrogen expelled into the tank to push out the chemical greatly increases the internal pressure.

Operation of the system is based on automatic controls actuated by rate-of-rise devices. Extent of auxiliary equipment depends upon the type and seriousness of the hazard. For example, as in other engineered fire fighting systems, the dry chemical unit detection device can cause doors and windows to close and halt all mechanical or electrically operated equipment.

Basically, the detecting device trips a diaphragm valve, either pneumatically or electrically, on the nitrogen tank, and this gas, under great pressure, easily distributes the dry chemical from the tank. Individual lines can be run to each hazard properly valved so as to eliminate excessive use of chemical.



High pressure carbon dioxide systems for fire fighting consist of several small tanks of CO_2, piping to the hazard area, electrical heat actuating devices, and controls. When such a system is actuated, the full supply of carbon dioxide is discharged from the tanks at a high pressure of 1000 psi

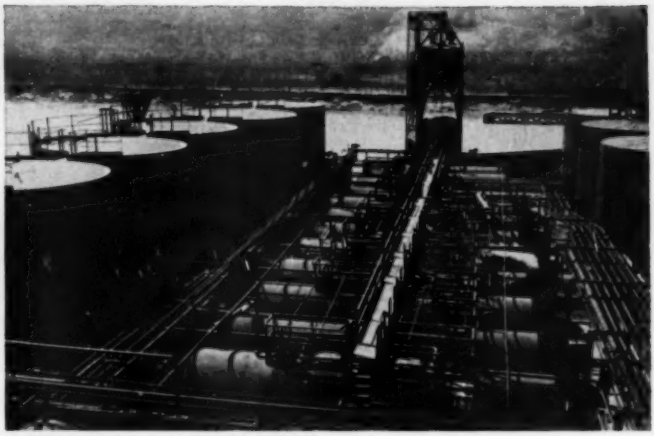


Chemical, stored in tanks, is distributed to hazard areas by means of high pressure nitrogen gas. Heat actuating devices detect an abnormal rise in temperature causing valves to open in the chemical and nitrogen tanks

foam protects coke plant tank farm

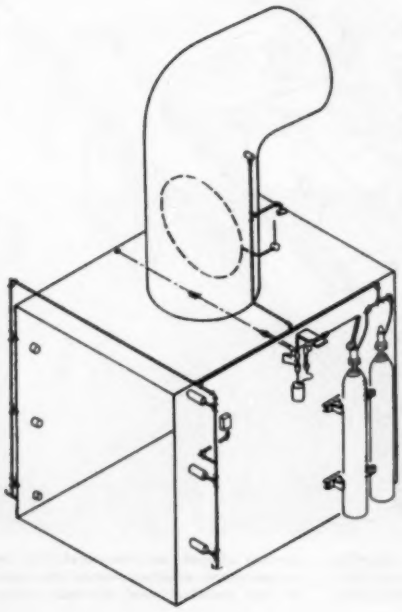
Foam systems protect this coke plant tank farm, which consists of 11 vertical tanks of 70,000 gal capacity each and 14 horizontal tanks of 20,000 gal. The farm has a total capacity of over a million gallons and is used for the storage of benzol, toluol, sylol, straw oil, fuel oil, and wash oil.

Any one of the large vertical tanks can be foam-flooded internally from the top. Dikes and trenches, subdividing the small horizontal tanks, can also be flooded. In addition, hydrants and hoses are available for the manual application of fire-smothering foam. Control of the tank farm system is from a small brick pump house about 300 ft away. The building contains pumps supplied from two independent electrical power sources, both city and company water mains, connections and valves, and a 550 gal foam storage tank.



Operation of the foam system is as simple as throwing an electrical switch and opening the appropriate, clearly marked valves. The operational sequence is outlined on a conspicuous wall chart. Valves, which control delivery of foam to the tank farm, are also labeled and include those for the hydrants, dikes, trenches, and individual vertical tanks.

high pressure CO_2 minimizes flash fire



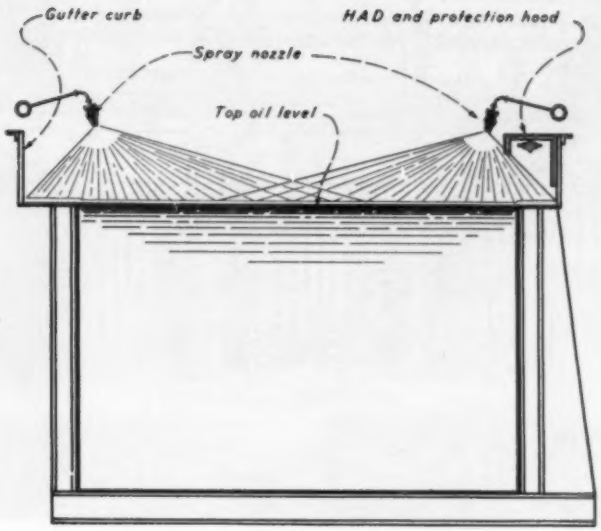
High pressure carbon dioxide protects this spray booth from flash fires. Nozzles are located at the entrance of the booth so a complete curtain of CO_2 blankets the fire. Without air movement, the oxygen is soon depleted, and the fire is smothered.

Two cylinders containing high pressure CO_2 are placed outside the booth. These units are connected in parallel with one valved with a lever arm connected to the actuating device. This actuating device consists of a weight and a fusible link located in the exhaust pipe of the spray booth. Heat from a fire causes the link to fuse releasing the weight, which drops pulling the lever to the open position of the one CO_2 cylinder. The CO_2 is discharged to the horn nozzles in the front of the booth. The second cylinder valve is ruptured by the excess pressure built up in the pipe system as the first cylinder discharges CO_2. Pressure, also built up in the piping system, actuates pressure-electric switches to shut down the exhaust fan and close the damper. Complete discharge of the cylinders takes approximately 30 to 40 seconds.

Another application for high pressure CO_2 can be found for a large electrical control panel installed at the finishing end of an electrolytic tinning line in a tin mill. If a fire should occur in this valuable board, a high pressure carbon dioxide fire extinguishing system is automatically actuated. The interior of the board is flooded with inert gas in seconds, and the fire is smothered immediately.

This system has a temperature-rate-of-rise detector. Sharp rise in temperature, as caused by fire, acts on the detector, which trips the carbon dioxide storage cylinder lever. Discharged carbon dioxide displaces the oxygen.

water spray reduces hazard in oil quenching tanks



Damage from fire in an oil quenching tank was materially reduced by installing a water spray system Tubing heated, on the first treatment, to 1400 F is quenched and then reheated to a comparatively low temperature of 750 F and requenched. Five 38 ft lengths of 6 or 8 in. dia tubing, treated as one load, are drawn from the furnace and quenched. Flames appear at each dip, but if one end of the bundle drops first a flash fire might occur before the other end is submerged because of increased flame. When such a condition exists the increased flame produces enough heat to ignite the entire tank.

Heat actuated devices placed along one side of the tank detect the rise in temperature and cause the tank to be flooded with a water spray. At the same time an alarm is sounded to alert workmen in that area.

Tank is deluged with water until the fire is out, and the water supply valve is manually closed. Water being heavier than the oil settles to the bottom of the tank, where it is drained.

fire protection vs new plant site

With an ever increasing sales demand, this varnish manufacturer had the proposition of relocating the plant site or increasing the storage facilities adjacent to the old plant site. One obstacle of relocation was the problem of moving all the manufacturing equipment, and the relative costs entailed. The only space available for expansion, at the old plant site, was between a railroad siding and property line, not more than 20 ft away.

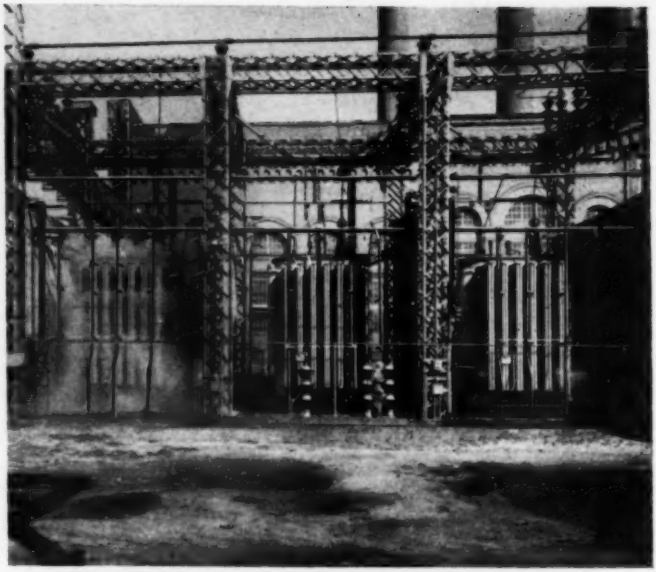
Management investigated the possibility of placing the tank farm between the siding and property line, only to find that the fire hazard would be too great. However, by properly protecting this tank farm with an approved fire fighting system they could utilize this narrow space.

An air foam system was installed that operates automatically at the slightest abnormal temperature rise. Nozzles are placed along the building to afford protection against sparks from switch engines and on each of the tanks. In a matter of 3 min the entire area can be flooded with foam.

overcoming electrical fires

Majority of factory fires start from electrical causes. In most cases the equipment is well designed, properly installed to meet code specifications. However, the principal source of trouble is inadequate subsequent maintenance.

Type and frequency of maintenance vary greatly with the equipment, location, and operating conditions. The following suggestions will help eliminate most electrical fire causes.



Motors

1. Keep windings, ventilating ducts, commutators, and brush rigging clean.
2. Lubricate regularly and carefully in accordance with the manufacturer's instructions.
3. Examine bearings on important motors daily, others weekly.
4. Check air gap between rotor and stator monthly.
5. Keep commutators smooth and brushes seated perfectly.
6. Motor leads are checked weekly to be sure the connections are tight, free from oil, and that insulation is in good condition.
7. Good ground connections are essential.
8. Overhaul motors annually, or more frequently when under severe operating conditions.

Wiring

1. Make sure that insulation is in good condition, and that locknuts and bushings on conduit and armored cable are tight. Particularly check locations where vibration is severe.
2. Pay particular attention to extensions, which usually receive hard wear.
3. Keep switch, junction, fuse and panel boxes clean and tightly covered at all times.
4. Keep open wiring clear of pipes and beams and well supported on insulators.

Control Equipment

1. Keep starting switches, compensators, and air circuit breakers clean.
2. Maintain contacts in smooth condition. Arced contacts should be replaced.
3. Replace worn parts.
4. Keep electrical and mechanical connections tight.
5. Maintain oil at proper level and in good condition.
6. Check tripping points of circuit breakers monthly.

Fuses

1. Make certain that circuits are not overfused.
2. Keep fuse clips clean and tight.
3. Be sure fuse assemblies in refillable fuses are tight. Ampere rating of "refills" should not exceed rating of fuse case.

Transformers

1. Keep oil in good condition and at proper level.
2. Make certain that transformer operating temperatures do not exceed 90 C.

Lightning Arresters

1. Inspect ground connections each spring and once or twice during summer.
2. Resistance should not be over 5 ohms. Never run ground wires through pipes for their protection unless wires and pipes are bonded.

Industry and Power wishes to thank the following individuals for assistance in making this report on engineered fire fighting equipment possible.

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Factory Insurance Association.
National Automatic Sprinkler and Fire Control Association.
Associated Factory Mutual Fire Insurance Companies.

During the change to higher utilization voltages, many scattered control components were centralized. For example, individually mounted units, above, for draw benches were consolidated in the single control box at the left for more efficient servicing and trouble shooting. Recorders show draw bench operating time

Penn Brass Changes

MOTORS AND CONTROLS TO 440 VOLTS

Complete conversion to a higher utilization voltage in a small or medium sized plant with a single power source requires carefully coordinated plans. Here are methods and techniques one plant used in changing to higher voltage

WALTER RUDOLPH

HEAVIER, LONGER DRAWS of copper tubing, a substantial increase in horsepower on draw benches, and other production efficiency measures at Penn Brass & Copper Company, Erie, Pa., increased demands on the power distribution system in recent years. Early in 1951, the decision for a complete change-over from the plant's main, 220 v, three phase power system to a 440 v, three phase system was made. It was planned to double power capacity, make a number of power distribution changes, and to put the entire power system on a more or less "pay-as-you-go" basis through savings in power costs and equipment maintenance.

Penn Brass purchases power from the Pennsylvania Electric Company. The distribution system as now installed has four times the former capacity. The change-over project was under the direction of Roy Lanyon, who engineered the conversion work. Progress reports, made during conversion, also explained what remained to be done before project completion.

Typical of the conciseness of the planning was the simple operational outline of April 1951, shown in Table 1.

The change-over was planned to be a gradual evolution of the 440 v system, with many temporary arrangements until the system was completely ready to switch over to the higher voltage, which required a crew of some 15 workers when the plant was shut down for two weeks vacation.

Installation of main distribution of 440 v power was outlined as in Table 2 for the program.

The 600 amp main fuse disconnect switches were replaced with air circuit breakers. Three oil-cooled transformers, 150 kva each, were wired into a closed delta connection with the old system and were made into a star connection in the change-over.

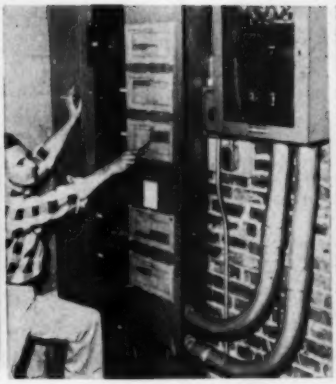
Starter Coil Voltages

Magnetic starter controls were changed from 220 v holding coils to 110 v control voltage, which was supplied from the 440 v lines at the magnetic switches through 50 and 100 va transformers. Nearly all switches in the plant were changed, most of them using small dry type transformers. In some installations, where three starters were grouped, larger transformers were stipulated.

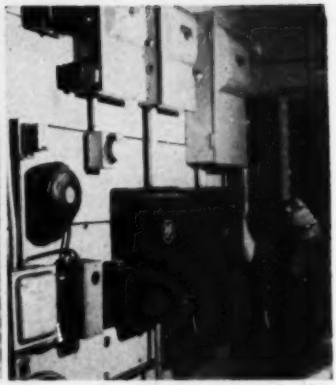
One of the main jobs in the program involved nearly 300 motors, which had to be reconnected while the plant was running. This was accomplished by building a temporary, portable panel board containing magnetic starters and controls. The panel was connected at a draw bench with flexible rubber cord to keep it operating while conduit and new panel boxes were installed.

The portable panel was moved from one bench to another as the work progressed, keeping down time to a minimum. Progress on this phase of the project was charted on a big sheet of paper, with green, red and blue markers—green showed a motor

Three 150 kva transformers supplied the original 220 v until they were Y-connected for the change-over to 440 v

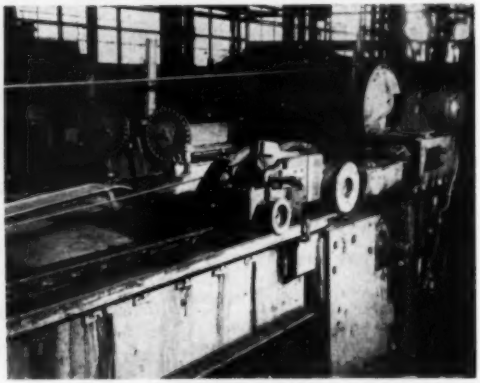


Areas controlled by each feeder breaker are colored on diagrams in main panel. New clock controls show at right

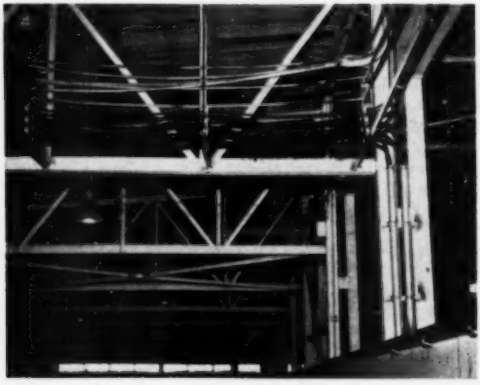


Compressor room controls, recorder for boiler blowdown and step down transformers are mounted together

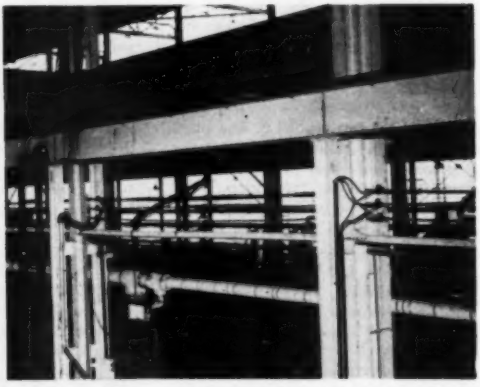
Operator's station controlling all functions of the draw bench is conveniently located, increasing operator safety and allowing more time to be devoted to drawing operations



The draw dolly, right, at finish end of the bench is here ready for automatic return. The higher utilization voltage allowed greater capacity and easier control maintenance



Open, mill-type feeder cables carried in cleat racks are used in the installation. Open conduit on these circuits supplies protection against mechanical injury as necessary



Drop lines are carried in conduit topped with a service head, left, for better protection against entrance of foreign matter. The old method is shown by drop line at right

TABLE 1—OPERATIONAL PLAN, 440 VOLT CHANGE-OVER

Motors, controls and wiring

1. Motor inventory.
2. Control inventory.
3. Recap and establish needs for:
   a. Rewinding motors. Get prices.
   b. Motor purchases. Size.
   c. Standard controls.
   d. 440/220 110 v transformers. Get prices.
   e. 110 v, 3 phase starter coils. Get prices.
   f. Fuse and heater requirements. Get prices.
   g. List control equipment now unsuitable for 440 v.
4. Check and order controls per 3c.
5. Order transformers per 3d.
6. Order coils per 3e.
7. Order fuses and heaters per 3f.
8. Order suitable controls per 3g, safety switches, etc.

TABLE 2—INSTALLATION OUTLINE FOR 440 V POWER

1. Determine cable needed for each of three 400 amp and three 225 amp feeders. (350 MCM).
2. Determine main panelboard (a breakdown of makes, prices and delivery dates).
3. Place orders for items 1 and 2 above.
4. Order bus duct, splice boxes, other material.
5. Fabricate angles. Weld to roof truss and columns for cleat racks carrying 350 MCM feeders to main busses.
6. Install bus duct and splice boxes.
7. Install main panelboard in new location.
8. Provide new incoming service conduit and service heads.
9. Install new feeders, connect to main panel, and position for immediate tap to busses.
10. Cut off 220 v power.
11. Sectionalize busses.
12. Connect new feeders to busses.
13. Turn on 440 v power.

ready for changeover; red, the 220 v wiring had to be reconnected or replaced; and blue showed the single phase, 110 v wiring, which was connected to the 110 v lighting circuit but would be connected to the power circuit when and where feasible.

Progress reports, as in Table 3, were meant to expedite the project as much as possible as well as contribute to the orderly handling of the complete job.

The system change provided a good opportunity for modernization and simplification of many controls. For instance, individual bench controls were formerly scattered, time-wasting in operation and made trouble-shooting difficult. They are now grouped as follows: Size 3 magnetic starter, Size 2 reversing starter, Size 1 starter, time-delay relay, 2 double pole relays, and service recorder, all operating on 110 v control supplied by one transformer rated 1 kva. All were stripped of any original enclosures and mounted compactly on a plant-made control box with hinged covers. Controls for two benches would be mounted side-by-side in one box. An innovation in this same control box was the inclusion of equipment that counts the number of tubes drawn on a particular bench, time intervals when no drawing was in progress, and footage drawn. This equipment operates on the impulses caused by motors using more current during a draw. Manual counting was replaced by small electrical counters, coupled with the draw recording equipment.

Other interesting features of the program include the addition of service heads on the conduits wherever a bus is tapped; this eliminates dirt, moisture and rubbing of insulation on wires. Two large service heads were included where lines enter the building because six 350 MCM cables (two in parallel) were installed instead of the 500 MCM size, providing an easier installation, more than doubled capacity, and more air circulation.

Floor operated cranes are being changed over to trolley duct feed systems for greater safety, less down time for maintenance, and more flexible or salvageable usage. The big main bay crane in the plant was completely rehabilitated.

Detailed inspection of the crane controls and wiring indicated a need for complete changes to maintain good operating condition. New controls would have cost $3500, but by buying some needed parts and using others from stock, as well as designing and fabricating a control panel, Penn Brass spent only about $500 for material plus $250 for labor. The controls were remotely installed on the crane bridge where they are easily serviced upon removal of sliding panels.

Old type drum controllers were replaced with new master controls, eliminating a maintenance problem on the former due to burned switch fingers, arcing between phases, and the like. The new master switches remotely control across-the-line reversing starters that work instantaneously.

Full current is applied to motor stators at all times. Cast iron resistors in the armature current circuit of the motors are connected to obtain three speeds on each of the crane's three motors: bridge, hoist and trolley. These resistors were mounted on the bridge of the crane for good air circulation.

With all control circuits operating on 110 v, many heavy cables that surrounded the crane cab were removed. Now only one 4 in. square duct carries approximately 32 wires (14 gage) to the cab. All high voltage wires and switches are located away from the crane operator, and he has more room to properly operate the crane.

Finally, a foot operated, dead-man switch was installed, and all controls are so interlocked that at no time can the master switch be energized until they are in a neutral position. This eliminates sudden crane movements

TABLE 3—440 V PROGRESS REPORT

257 motors in the plant.
200 reconnected or rewound for dual voltage, O.K. for 440 v.
57 to be reconnected rewound or replaced. **85% complete.**

275 safety switches in plant.
180 replaced, rewired, relocated. O. K. for 440 V.
95 to be replaced, rewired, relocated, **65% complete.**

204 coils to be replaced with 110 or 440 v coils.
30 changed to 110 v.
174 to be changed, **15% complete.**

110 transformers (50 and 110 va) to be installed.
10 installed, **9% complete.**

17 transformers (1.5 kva) to be installed.
4 installed, **23½% complete.**

15 benches to be rewired.
3½ rewired, **23½% complete.**

Main entrance panel to be installed and wired to outside entrance. **80% complete.**

One transformer (10 kva, 3 phase) to be installed for battery charger and dieroom plating rectifier unit, **100% complete.**

Main feeders from present power busses to main panel. ***Nothing done on this.***

Main power busses to be cut in half. ***Nothing done on this.***

Bus duct to be installed in south bay. ***Nothing done on this.***

when the master switch is engaged.

Equipment used on this crane project is of standard types, with interchangeable parts, minimizing delays for parts in event of breakdown. This project was considered of special importance because much production time is lost when the crane is shut down for maintenance.

It is interesting to note, too, that conduit installations were eliminated in the new 440 v feeder system, except where mechanical injury was a consideration. Greater capacity for a given wire size, more economy and more efficiency were advantages claimed for the open, mill type feeders installed with nested cleat racks.

Penn Brass had to consider copper oxide rectifier change-overs, two of them being used for fork truck battery charging, and for electric plating of dies (chrome plate) in the tool department. It was estimated rewinding transformers of each would cost $200. Instead, a three phase, 10 kva transformer was purchased, for about $110, to reduce 440 v to 220 v.

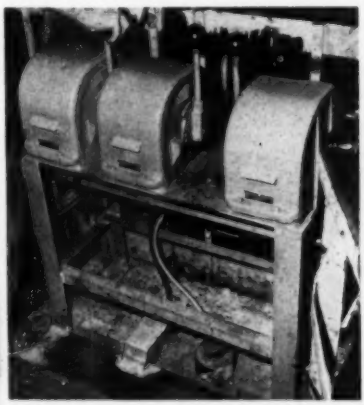
The battery charger was installed on the roof of the tool crib near the point of use to provide more floor space. The automatic control box, accessible from floor level, also contained the ammeter and voltmeter removed from the charger case.

For emergency trouble-shooting at the main distribution center of the plant, five layouts of the entire plant were mounted on the back of the distribution box door. Each "picture" shows the section controlled by a particular breaker by colored areas.

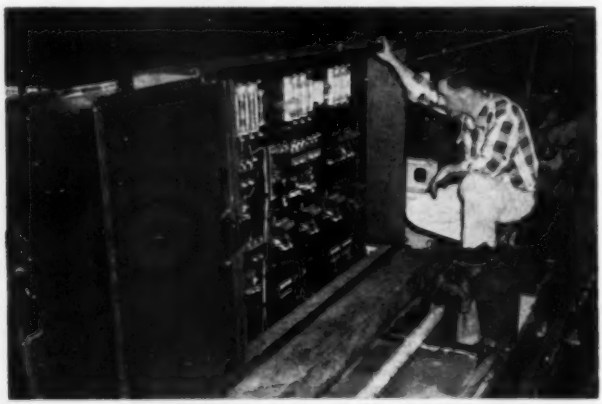
Along with the change-over project, a new master control for all secondary clocks and the time clocks at the plant was installed. Installation procedure called for conduits for carrying wiring all over the plant, but because of the low voltage involved, it was decided to try armored thermostat cable, at considerable savings in time and materials. The installation has won approval on the wiring method from the master control manufacturer.

MANUFACTURERS OF PRINCIPAL ELECTRICAL EQUIPMENT

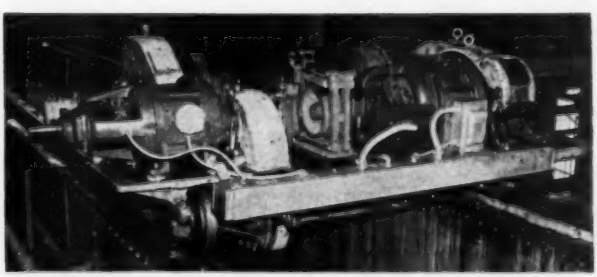
Power transformers	General Electric Co.
Power transformers	Dongan Electric Mfg. Co.
Switchgear	Westinghouse Electric Corp.
Bus duct	BullDog Electric Products Co.
Crane controls	General Electric Co.
Open mill type feeders	Efficiency Electric & Mfg. Co.
New motors	Belgian Electric Sales
Switches and controls	Allen-Bradley Co.
Switches and controls	Cutler-Hammer, Inc.
Switches and controls	Allis-Chalmers Manufacturing Co.



Drum type crane controls were replaced by these modern control stations in operator's cab. Note the dead man switch at the bottom

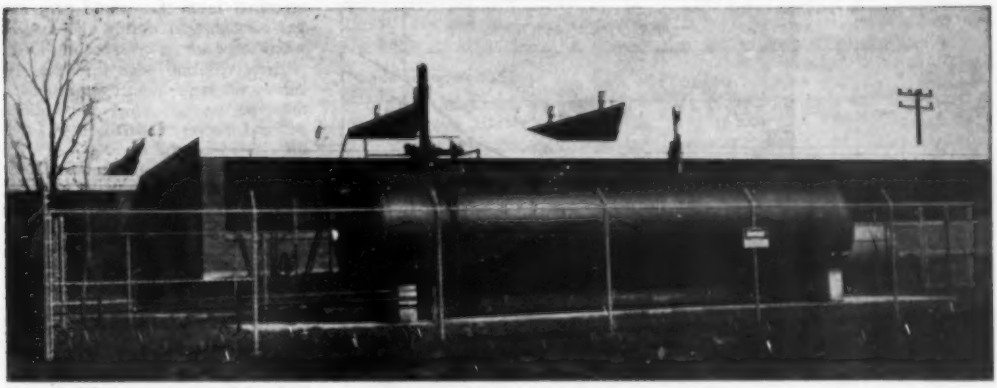


Main control equipment for the crane's three motors is remotely located on the bridge of the crane, as are the cast-iron, speed control resistors. Sliding doors on the panel contribute to easy inspection and maintenance



Complete renovation of the crane included addition of a solenoid brake along with rewiring and the like. Note that all loose wiring is enclosed

Bus duct is employed where frequency of the taps on the feeders justified installation



Typical LP Gas plant located in New York State. Mixing equipment is installed in main building in background

ADVANTAGES OF INTERRUPTIBLE RATE NATURAL GAS SERVICE

PAUL E. PEACOCK, JR.
LP Gas Plant Engineer
And Design Consultant

Many industries install standby LP gas plants to supplement or replace natural gas during peak demand periods. This permits the use of interruptible gas service which reduces annual fuel costs

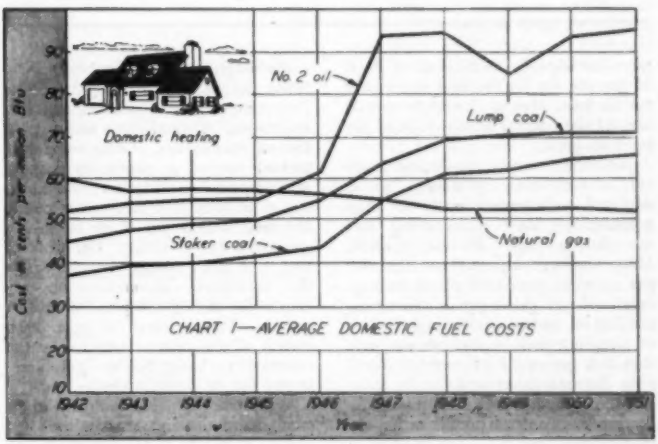


CHART 1—AVERAGE DOMESTIC FUEL COSTS

THE INTERRUPTIBLE GAS RATE offers a considerable saving to most large industries in areas served by natural gas. However, when taking advantage of this economical rate industry assumes the responsibility of providing an adequate standby plant for use during periods of natural gas curtailment. In some cases, improper understanding of this responsibility has resulted in considerable financial loss both to the industry through lost production and to employees in loss of pay.

In the past many gas utilities have offered their industrial users a choice between interruptible and firm gas rates. Recently, the trend has been toward elimination of the optional feature for larger industrial consumers because of factors beyond the control of the utility. With one large utility system, consumers using more than 12 million cu ft of gas per year are now automatically placed on the interruptible rate. As a service to industrial gas users, as well as gas utilities and pipe line companies, this article will present some pertinent factors involved in application of the interruptible gas rate.

Following World War II, most heating fuel prices were not restricted and costs spiraled upward. At this same time, gas prices were controlled and regulated to such an extent that an unprecedented demand for gas heating resulted in large backlogs of orders for heating installations. Chart No. 1 shows in some detail the unbalanced cost of heating fuels during the past ten years that caused the tremendous demand for gas heating.

In an effort to meet this demand, pipe line companies and gas utilities made an all-out effort to increase available gas supplies. Chart No. 2 illustrates how one pipe line system expanded its facilities. This chart gives

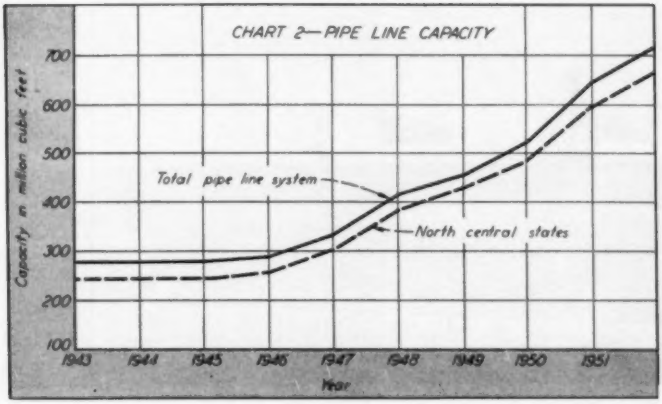


TABLE 1—POTENTIAL SAVINGS FROM APPLYING INTERRUPTIBLE GAS RATES

Monthly usage in cubic feet	Average cost per therm		Annual savings on interruptible rate
	Firm rate	Interruptible rate	
1,000,000	9.51¢	7.49¢	$2,424.00
2,000,000	8.91¢	5.89¢	7,248.00
3,000,000	8.54¢	5.36¢	12,448.00
4,000,000	8.35¢	5.10¢	15,600.00
5,000,000	8.24¢	4.94¢	19,800.00
10,000,000	8.02¢	4.62¢	40,800.00
20,000,000	6.91¢	4.23¢	101,520.00

pipe line capacity in millions of cu ft of gas per day for the total system and for facilities serving the north central area of the country where demand has been so great.

Additional service was made available in some cases by storing gas in depleted underground wells at high pressure and then withdrawing this gas during high demand periods. Many utility companies installed LP gas or other peak load plants to augment natural gas supplies. However, the cost of storing gas underground or of installing peak load plants was such that this gas could be used to serve only domestic customers.

The unbalanced characteristic of the heating gas demand caused such poor load factors that pipe line companies and utilities soon found it impossible to operate economically. Pipe line companies were forced to place some control on the average annual amount received by utility companies. One of the first restrictions imposed was to charge a high price for all gas used over the maximum contract amount on peak load days. In one case, the charge was $10 per M cu ft for all gas taken by the utility above the contract maximum. This additional gas cost the utility $10,000 for each million cu ft. When this gas was being sold to industrial consumers at about $400 to $600 per million cu ft, it is obvious the industry had to have its gas service cut off.

Although this penalty helped to lower the peak days somewhat, pipe line companies and utilities still had unbalanced seasonal loads and further control was desired. Today trends are toward use of a commodity-demand rate by pipe line companies when selling to utilities. The commodity rate is the usual charge per M cu ft for all gas taken by the utility. The demand rate is a fixed charge determined by the maximum consumption on any single day during the previous twelve months. This amount is paid each month of the year in addition to the commodity charge but no gas is received for the demand charge.

With one pipe line company, commodity and demand charges are 30¢ and $4.50 per M cu ft respectively. At these rates, a utility receiving one million cu ft of gas on their peak day would pay $300 for commodity charges. However, since demand charges would be paid for twelve months, this million cu ft would cost the gas utility 1000 x $4.50 x 12 or $54,000 per year. Adding the commodity charge to this amount shows the total actual cost of this particular one million cu ft would be $54,300. Thus utilities found it imperative to curtail or cut off service to large industries during peak load days. With this condition, utilities faced the dual problem of: (a) satisfying existing industrial customers, and (b) adding industrial loads that would even out gas consumption during the months when there are no peak heating loads.

After reducing peak load days by cutting off large industrial consumers, the pipe line companies and utilities still had the very unbalanced load factor created by the heating load over which neither company had any control. This condition could be corrected only by adding more interruptible or seasonal gas users.

Since the demand had already been established on the peak day during the winter heating season, any additional gas sold the rest of the year up to that maximum daily amount would be bought by the utility at the commodity charge. This cost, to the utility in question, would be 30¢ per M cu ft or 3¢ per therm. With the utility overhead and most operating costs charged to assured gas sales at the firm rate, it remains then that the utility could sell additional gas at an interruptible rate which provided a nominal profit above the 3¢ per therm thereby greatly increasing annual sales. This would balance out the load factor for both utility and pipe line company and make gas available to industry at rates that would justify a standby plant.

Advantages to Industry

Interruption of gas service to large industries has not been limited to those consumers operating on interruptible gas rates. Often it has been necessary, because of unusually cold weather, pipe line breaks, or other contingencies, to cut off firm rate customers. Now with the lower interruptible rates, all large industrial gas users can protect their operations and production by installing a proper standby plant that will be paid for out of savings in the annual gas cost. For example, the rates of a large north central state's utility listed in Table 1 show the savings between firm and interruptible rates. It might be pointed out, however, that this company will no longer take large industrial loads on firm rate and is encouraging present users to switch to interruptible rate.

Savings realized by use of the interruptible rate are substantial. This is a very definite advantage to industry and also provides both utility and pipe line companies with more stable annual gas load. The only problem now remaining is proper protection for industry during periods of natural gas supply curtailment. This problem is easily solved by installation of a suit-

*"LP Gas Is the Answer to Standby Fuel Problems at Industrial Plants", INDUSTRY AND POWER, May, 1951. Reprints may be obtained by addressing the author at P. O. Box 268, Westfield, N. J.

able standby plant by the industry.

In some process applications it is possible to use almost any type of fuel and obtain satisfactory results. However, most industries are using natural gas because of the high quality product they can produce, and many companies have found gas is the only fuel that can be used satisfactorily in their operations. With this condition, many industries select propane-air gas for standby service in preference to other types of fuel.

Some of the characteristics of propane-air gas were discussed at length in another article by the author.* A few of the more obvious advantages that were presented include: (a) propane-air gas is unexcelled for purity and uniformity and provides the same high quality as natural gas, (b) it is completely interchangeable with natural gas in the same lines and equipment, either mixed with natural gas or as complete replacement for natural gas, and (c) standby plants are easily and quickly started, and once started will operate automatically with but little attention from existing boiler or engine room personnel. These and other important advantages illustrate why many industrial gas users on interruptible rate service are turning to propane-air gas as a standby fuel to natural gas.

The present delivered cost of propane liquid to the area served by the gas utility company used in the previous example is 8.22¢ per therm. This is based on the present ceiling price of propane and present freight rates. During summer months, propane usually can be purchased at less than ceiling price, and this summer rate would make delivered cost about 6¢ per therm. For purposes of comparison, the higher cost figure will be used.

Propane Storage

Normal practice is to install sufficient propane storage to supply the industry for one month of 100 per cent curtailment. Some utilities curtail on a percentage basis and some cut service 100 per cent for shorter periods. The average usually approximates an equivalent of one month of 100 per cent curtailment. Industry can thus plan on natural gas supply for eleven months and propane-air gas service for one month. Annual cost of both is the value to be used in comparing interruptible and firm rates.

Two cost comparisons based on industries using 2,000,000 and 5,000,000 cu ft of gas per month respectively are shown in Table 2. It is interesting to note that the fuel cost of propane-air gas is less in both cases than the average firm rate cost. So regardless of length or percentage of curtailment, fuel costs are lower when using interruptible service supplemented by a standby plant.

The cost of a propane-air gas plant will vary from one industry to another. Some of the deciding factors are: (a) whether the gas will be high pressure or low pressure, (b) availability of existing railroad sidings or other unloading facilities at the site, (c) whether an existing building or section of a building can be used for the mixing equipment or a new building is required, and (d) if steam is available for artificial vaporization of the propane liquid in cold weather. A typical low pressure plant will be considered where gas is used at not over 7 psig, there is an existing siding, steam is available, and no new building is required.

Normal propane storage tanks are 67 ft long and 9 ft in diameter, have a water capacity of 30,000 gal and weigh about 40 tons. The propane capacity of one tank is equivalent to approximately 2,500,000 cu ft of natural gas. Installed cost of such a tank including freight, rigging, foundations, painting, trim equipment, and accessories approximates $15,000 although unit costs for multiple tank installations may be lower.

The price of the unloading compressor, hose, and other unloading equipment will be about $3000 installed, while vaporizing equipment is worth approximately $2000 for all but the larger installations. Mixing equipment cost will vary with the size of the hourly load but not in direct proportion to it, since a 60 M cu ft per hr unit, for example, costs only about ⅓ more than a 30 M cu ft per hr unit.

Table 3 summarizes the estimated costs of installing standby propane-air gas plants that will supply 2,000,000 and 5,000,000 cu ft per month consumers. These sizes were selected so equipment costs could be compared with savings listed in Table 2 for similar service. While no interest on the investment is included, the savings of $6782 and $18,160 indicate the smaller plant would be paid for in less than 4½ years and the larger plant in less than 3 years.

It should be remembered that savings are based on buying propane at ceiling price. With adequate storage, propane can be bought during summer months at less than ceiling price and retirement time would be less than shown. In addition, industry would be sure of continuous operation.

The above figures prove the economy of using interruptible gas rates coupled with a propane-air gas standby plant. With the trend toward reduced application of firm rate service by utilities, it would appear advisable for large industries to consider installation of a standby gas plant now in anticipation of transfer to the interruptible rate. This rate is designed expressly to benefit industry as well as utilities, and both companies will improve their operations by a more general use of this type of service.

TABLE 2—COST COMPARISONS BETWEEN FIRM AND INTERRUPTIBLE RATES

Annual firm rate cost for 2,000,000 cu ft per month at 8.91¢ per therm		$21,384.00
Annual interruptible rate cost for similar service		
11 months using natural gas at 5.89¢ per therm	$12,958.00	
1 month using propane—air at 8.22¢ per therm	1,644.00	
Total cost of natural gas and propane—air gas		14,602.00
Annual savings in fuel cost on interruptible rate		$6,782.00
Annual firm rate cost for 5,000,000 cu ft per month at 8.24¢ per therm		$49,440.00
Annual interruptible rate cost for similar service		
11 months using natural gas at 4.94¢ per therm	$27,170.00	
1 month using propane—air at 8.22¢ per therm	4,110.00	
Total cost of natural gas and propane—air gas		31,280.00
Annual savings in fuel cost on interruptible rate		$18,160.00

TABLE 3—APPROXIMATE INSTALLED COST OF PROPANE—AIR GAS PLANTS

Price for system to supply 2,000,000 cu ft per month service	
One 30,000 gal storage tank	$15,000.00
Unloading equipment	3,000.00
Vaporizing equipment	2,000.00
Mixing equipment, regulators, piping and accessories	10,000.00
Total estimated cost	$30,000.00
Price for system to supply 5,000,000 cu ft per month service	
Two 30,000 gal storage tanks	$30,000.00
Unloading equipment	3,000.00
Vaporizing equipment	2,000.00
Mixing equipment, regulators, piping, and accessories	15,000.00
Total estimated cost	$50,000.00

This is one of twelve articles by Paul E. Peacock, Jr., nationally recognized authority in the LP gas engineering and operating field. Since 1930 he has designed more than 80 peak load and standby plants for gas utilities and industrial firms, including several installations in foreign countries.

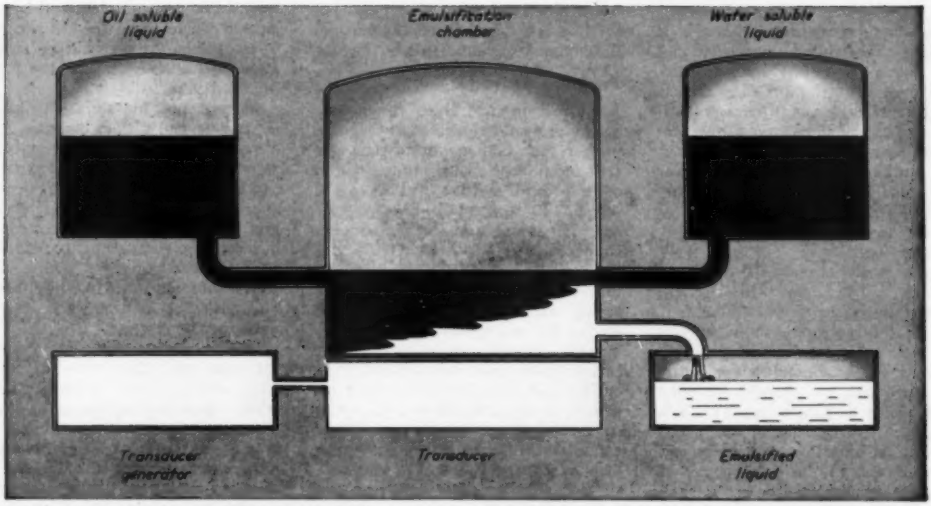


Fig. 1—One of the most important applications of ultrasonics is in combining liquids or other materials not readily miscible. In a simple arrangement, the transducer generates sound waves in the emulsification chamber

ULTRASONICS IN OVERALLS

Ultrasonics is finding more and more applications in industry as a practical processing tool. As with every new method, there have been many confusing claims and counterclaims. But here is a conservative survey of actual applications, basic theory and many associated factors, such as safety precautions

FRANK CHARITY, *Consulting Engineer*

INDUSTRIAL ULTRASONICS, climaxing nearly a century of laboratory work, is being increasingly accepted. Ultrasonics in itself is application of sound waves of extreme frequencies or intensities.

At present, the most practical applications appear to include nondestructive testing of materials, precipitation of smoke and other airborne particles, dispersion of immiscible chemicals, automatic control of industrial machinery, precision cutting of extremely brittle substances such as ceramics, rapid cleaning or degreasing of small parts, and the difficult task of soldering aluminum alloys. However, ultrasonics has many possibilities that may at any time result in practical applications.

Some ultrasonic generators are already being manufactured for prices in the neighborhood of $1000 each. It seems probable that similar units will soon be sold for $500 or less as the result of design improvements and increased production. Principal generator types (superscripts refer to list of acknowledgements) are:

1. *Sirens*[1]—These are functionally the same as the signalling devices used by firemen, but are capable of producing sound waves of much higher frequencies (more than 20,000 cps) and greater intensities (up to about 200 db). Generators of this type are used to produce ultrasonic waves in gaseous media—for example, to agglomerate and precipitate smoke and dust particles suspended in air.

2. *Magnetostrictive generators*[2]—This type is capable of producing sound waves with frequencies up to about 100,000 cps with intensities of 100 db or more. In a magnetostrictive generator, a ferromagnetic vibrator expands and contracts under influence of a coil energized with current oscillating at the natural frequency of the vibrator. Resultant sound impulses can be readily propagated in liquid or solid media—for example, to agitate chemical solutions or to actuate cutting tools for machining extremely brittle materials.

3. *Electrostrictive generators*[3]—Radio frequency current is converted into ultrasonic vibrations by its ability to rapidly expand and contract quartz, or related types, of piezoelectric crystals. These generators are used where the highest ultrasonic frequencies (up to about 500,000,000 cps or 500 megacycles) are required—for example, in the nondestructive testing of materials.

Most of the generators can be used to produce sound waves of both audible and inaudible frequencies with alternating current (supplying a motor or oscillator) from any standard source of power. Efficiency in most cases depends on the nature of the application. Rather large heat losses are unavoidable in many circumstances, but where heating effects are specifically desired it is possible to concentrate ultrasonic

energy with almost 100 per cent efficiency in certain materials.

Sound waves travel in any elastic material, whether gas, liquid or solid, with a velocity which depends primarily on the elasticity and density. The waves, introduced at a given location, are propagated until they strike a discontinuity in the material, when they are partially or wholly reflected. Liquids such as oil or water are normally used between the vibrating element (of an electrostrictive or magnetostrictive generator) and the material which is to carry the sound. This reduces the effect of imperfect contact between surfaces and greatly increases transmission of sound energy.

Inspection

In one type of ultrasonic inspection equipment[4], an electrostrictive generator is used to produce an ultrasonic impulse in a piece of material to be tested. The wave is propagated by the material until it strikes a discontinuity, such as a gas pocket or the other side of the piece. A defect partially reflects the ultrasonic impulse so that some energy returns to a pickup near the source, where it is amplified and used to actuate the vertical deflecting plates of a cathode ray tube. The horizontal sweep is calibrated for visual observation of echoes in accordance with the time required to produce and reflect each energy impulse from the opposite end of the piece. Echoes from defects appear as pips on the sweep trace at a distance between source and end echoes proportionate to location in the inspected material. Thus, it is possible to ascertain the presence and location of defects in substances which could not be inspected with X-rays.

Railroads are among the most important users of ultrasonic inspection equipment at this writing—having mobile units for the continuous testing of rails, as well as shop facilities for the inspection of axles and other vital components of locomotives and cars. Such equipment may reduce operational failures by 50 to 90 per cent without any appreciable increase in maintenance costs.

An ultrasonic gage is used to check the critical dimensions of materials or parts which could not be accurately inspected with conventional measuring instruments. In principle, the gage functions like the inspection equipment.

Still another ultrasonic inspection device[4] projects ultrasounds through various materials or parts in a saline solution so as to actuate a special receiving and recording device. The saline solution prevents or reduces the sort of reflections essential to the operation of ultrasonic inspection and

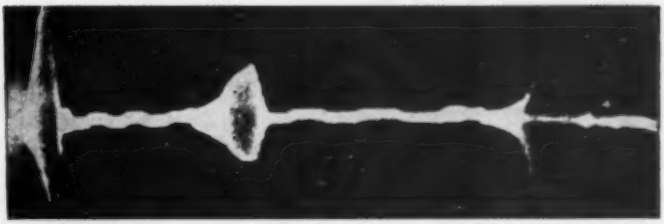


Fig. 2—In inspection and gaging, sound waves travel through the material, are reflected by defects and opposite surface. Echo impulses, amplified for the oscilloscope, show sending pulse, left; defect, center; and opposite surface at the right

Fig. 3—Where shaking by hand, left, may cause accelerations about twice that of gravity, the alternate compression and rarefaction due to sound waves greatly increases acceleration, allowing reactions heretofore impossible or difficult

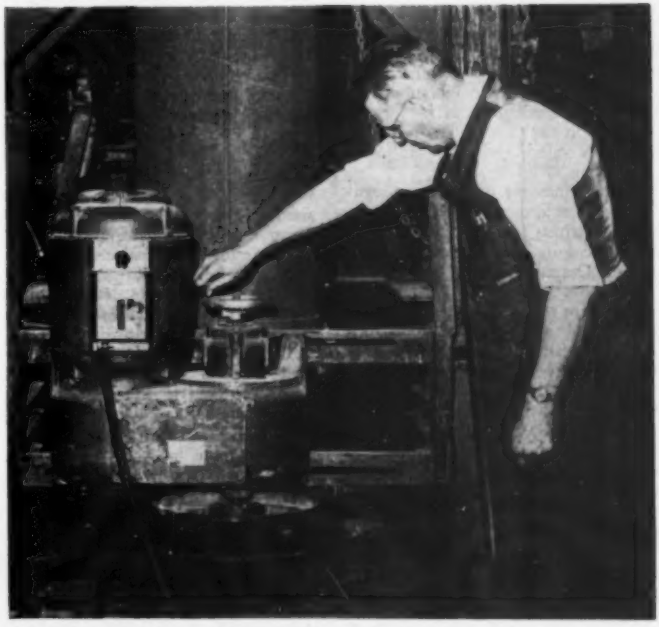


Fig. 4—Sirens produce sound waves directly in air or other gases and are therefore most efficient for agglomeration of dust or mist suspended in gases. Unit above precipitates industrial aerosols, reducing air pollution. Note adjustment

gaging equipment described above. This device is said to be most advantageous where large quantities of identical materials or parts should be continuously and accurately tested with maximum speed in a small space.

Agglomeration in Gases

Compared with other devices used in the agglomeration and precipitation of industrial smoke and dust particles, ultrasonic sirens have the virtues of simplicity and low cost. This is indicated by the following description of a siren[8]:

"This siren has a rotor facing a stator with precision-matched ports around the periphery of each. A compressed gas is passed through the ports of the rotor and then the stator. As the rotor turns, alternately opening and closing the ports of the stator, the gas flows intermittently. An intense sound wave is thereby created at the interface of the siren, and this is directed from the siren by an acoustic horn. Intensity of the wave is governed by the pressure of the compressed gas; frequency, by the speed at which the rotor turns. A variable speed motor with autotransformer can be used to vary the speed of the rotor. About 225 cu ft of air, compressed to 8 psig, will normally produce a sonic field of adequate intensity."

Frequencies used in operating a siren are varied in accordance with the dimensions of the smoke or dust particles which must be agglomerated and precipitated. Large particles (up to 10 mu in size) can be clumped with audible sound waves (in the neighborhood of 1000 cps); small particles (as little as 0.01 mu in size) necessitate the use of inaudible sounds (with frequencies of 18,000 cps or more).

Output intensity of a siren is regulated in accordance with the area through which sound energy must be propagated in each different circumstance. Output intensity is nearly proportional to input energy; and, if it is necessary to precipitate 10,000 to 100,000 cu ft of smoke per min, satisfactory intensities can be maintained with 10 to 50 kw of power.

Agitation of Liquids

In the agitation of solutions, magnetostrictive generators are normally used where high output intensities are required; electrostrictive generators, where high output frequencies are needed.

High intensities and relatively low ultrasonic frequencies appear to be especially desirable where it is necessary to increase wetting action of a solution —for example, to reduce time required to clean or degrease an article immersed in soapy water or an organic solvent.

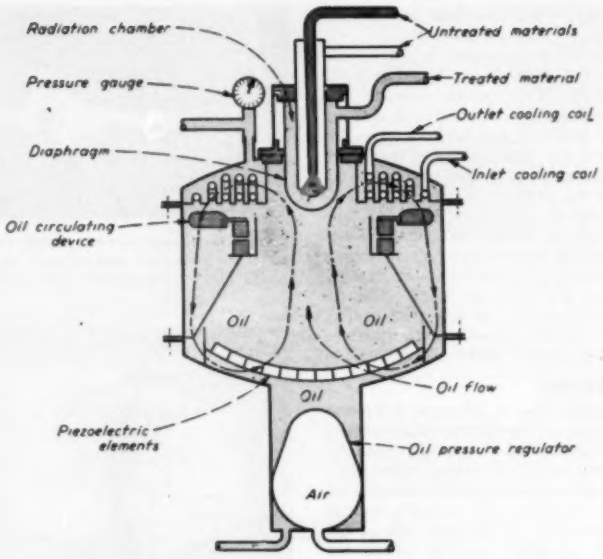


Fig. 5—This is a recently developed design of ultrasonic processing equipment using piezoelectric (electrostrictive) type elements. Arrangement of elements focuses waves through the diaphragm on the point, P; oil is a good conductor

Cleaning with ultrasonic agitation for 5 to 10 sec in a lukewarm solution has been found equal to cleaning in a boiling solution for 10 to 20 min.

One of the magnetostrictive units[3], designed for cleaning small parts such as optical lenses, can be operated at a constant frequency of 24,000 cps with only one kw of driving power.

Soldering and Machining

Another magnetostrictive device[5], developed in London, is now being used to agitate the electrically-heated bit of a soldering iron. Purpose of this is to create cavitational effects which will disperse impurities (break up surface layers) and thus facilitate soldering aluminum and other metals which form refractory oxides.

At least one company has devised a commercial magnetostrictive unit[6] which can be efficiently used to machine sintered carbides or borides, hardened tool steels, ceramics and the like. This unit has been described as a magnetostrictive generator used to drive a blunt tool having the same shape as the cut or hole to be made in a workpiece.

The tool is driven head-on into the work at an ultrasonic frequency of 27,000 cps, the vibrations causing accelerations in the order of 70,000 times that caused by the force of gravity. Actual cutting is done by a stream of inexpensive commercial abrasive fed into the work area in a liquid carrier. Holes, openings, and recesses having any arbitrary shape can be formed in the hardest materials in diameters from 0.007 to 2 in. with tolerances of 0.002 in. The blunt tool may comprise any tough malleable metal, such as cold-rolled steel, and it is kept under slight tension against the work, which is held in a suitable jig. Extremely rapid tool vibrations hammer abrasive particles against the work, causing myriads of chipping actions. Cuts are produced rapidly and are extremely smooth.

Synthetic crystals

Electrostrictive generators are, without doubt, the most versatile sources of ultrasonic power because they are capable of producing the specific output frequencies required for optimum operational efficiency in a majority of circumstances. But, until recently, they were sadly limited in output intensities of natural piezoelectric crystals.

Now, by a recently developed technique, piezoelectric crystals are being synthesized from heat-fused ceramics and electrostrictive generators are attracting wide industrial attention.

1. One company has been able to reduce cleaning costs by 58 per cent in the processing of electric shaver heads, using an electrostrictive generator to agitate cleaning solutions.

2. Another company is reportedly using an electrostrictive generator to

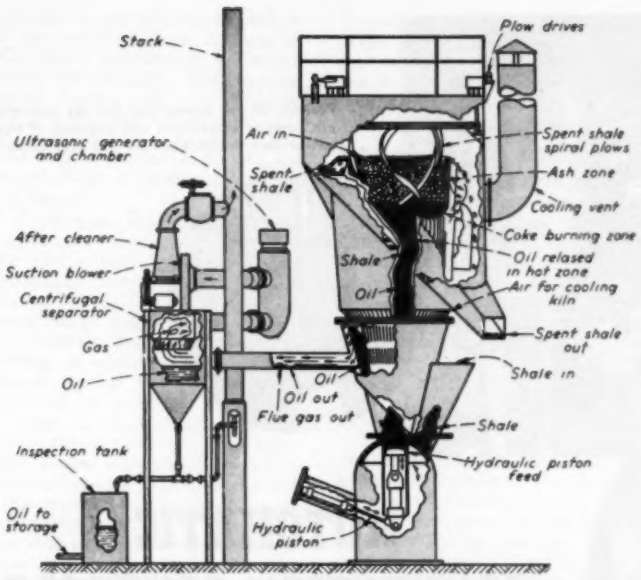


Fig. 6—Kiln at right recovers oil from shale, which is pushed up through heated zone, loses oil to flue gas, spills over rim. Down-flowing flue gas carries oil to the separator, then to ultrasonic chamber that agglomerates residual mist

facilitate the emulsification of waxes and solvents in the production of polishing compounds.

3. A growing number of textile manufacturers are using electrostrictive equipment to accelerate the dyeing of hydrophobic fibers (such as Nylon and Orlon fibers), the dispersion of oil-soluble dyes or tints in water, the oxidation of water-soluble dyes, and similar operations.

4. Plating companies and the like are using electrostrictive equipment to agitate electrolytic agents in order to halve the amount of time normally required to electroplate metal products.

A typical production-type electrostrictive generator has a power input rating of 115/230 v, 60 c, and 3000 w of single-phase current; a power output rating of 1500 w at 125,000 cps. This unit is housed in a 48 x 30 x 39 in. console cabinet, mounted on casters, and weighs about 1500 lb.

"Scare stories" have retarded the use of ultrasonics in many plants, since no modern manufacturer would knowingly equip his plant with an accident hazard. These stories are probably not deliberate falsehoods, since ultrasonic energy (like gasoline and electricity) can be dangerous in certain circumstances; but they are usually exaggerations due to lack of information.

Ultrasonic energy is probably the least effective killer known to modern science, but it can be an excellent stimulant and electrostrictive generators are made for therapeutical purposes.

Sound waves with frequencies exceeding 100,000 cps can be regarded as harmless for most practical purposes. While they can be propagated for considerable distances in liquids and solids, they cannot be generated with enough intensity to penetrate a layer of ordinary air for a distance of 2 in. Workers in the vicinity of equipment producing high ultrasonic frequencies can get severe burns if they touch uninsulated parts of the equipment, but accidents of this type can be readily avoided by making effective use of warning signs and heavy gloves.

Ultrasounds of high intensity at frequencies of less than 100,000 cps can usually be isolated with acoustical insulation materials; but, where this is impractical, good ear plugs and a pair of heavy gloves can give all the protection needed for work in the vicinity of ultrasonic equipment. Ear plugs are essential because inaudible sounds can shatter an ear drum without warning.

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ACKNOWLEDGMENTS

Information contained in the text is related primarily to equipment of the following manufacturers. Because of rapid development, this is not presented as a complete list.

1. **Sirens—G-B Brass & Aluminum Foundry, Inc.; Ultrasonic Corp.**
2. **Magnetostrictive generators—Raytheon Manufacturing Co.; Cavitron Equipment Corp.; Massa Laboratories, Inc.**
3. **Electrostrictive generators—Brush Development Co.; The Bertcher Corp.; General Electric Co.; Sperry Products, Inc.; Fisher Scientific Co.**
4. **Ultrasonic inspection—Sperry Products, Inc.; Brush Development Co.**
5. **Ultrasonic soldering iron—Mullard Electronic Products, Ltd.**
6. **Ultrasonic machining—Cavitron Equipment Corp.**

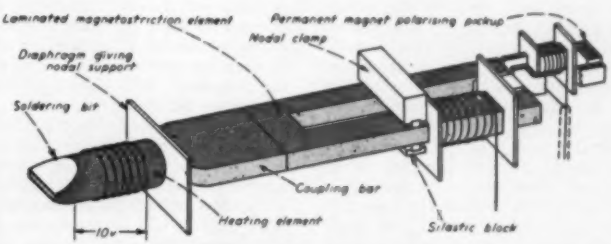
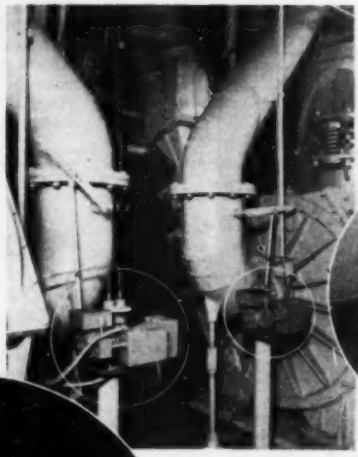
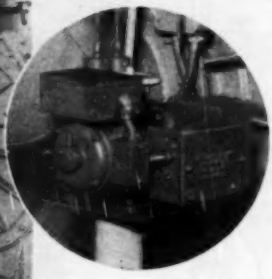


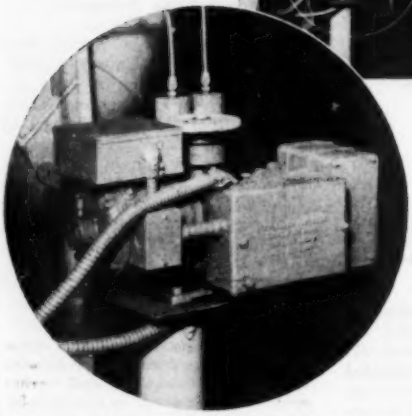
Fig. 7—Some metals, like aluminum, are difficult to solder because of refractory oxides. In this soldering iron design, ultrasonic waves transmitted through bit to solder and metal, break oxide layers and improve wetting and alloying action



Many installations have two or more pulverizers serving the same boiler



Position of the power unit for the primary air damper establishes the position of the power unit which controls the fuel feeder



One method of control utilizes power units to adjust dampers on the pulverizers that regulate primary air flow through the mill

AUTOMATIC COMBUSTION CONTROLS FOR PULVERIZERS

Automatic combustion controls are an essential part of fuel burning installations. This article presents factors involved in the application of controls for the specific requirements of pulverized coal firing

WILLIAM H. PUGSLEY
Vice President in Charge of Field Research
The Hays Corporation

ALL PUVERIZERS must perform certain similar functions. These duties are to: (a) feed fuel into the mill in proportion to the demand for pulverized fuel, (b) separate foreign matter from the fuel, (c) pulverize the fuel, (d) separate fuel that is sufficiently fine from that which is too coarse and return the coarse portion to the mill for further grinding, and (e) remove pulverized fuel from the mill and send it to the burners. The mechanical elements required to accomplish these various functions may or may not be combined in one unit. Equipment arrangement will be determined by the pulverizer capacity, physical layout of the plant in which equipment is to be installed, and design and construction of the pulverizer utilized.

Two common methods are used to control the quantity of pulverized fuel flowing from the mill to the burners. One method is to regulate raw fuel feed rate into the mill according to the demand for heat. The other method is to control the rate of primary air flow through the mill since this air carries the pulverized fuel. Hence, its flow determines pulverized fuel flow rate.

Various methods are used for feeding fuel into the mill or grinding chamber. One method utilizes a rotating feeder table with a plow or knife to scrape fuel off of the rotating table from which it falls by gravity into the mill below. Both plow position and table speed affect the quantity of fuel flowing to the mill. This type of feeder controls the quantity of pulverized fuel leaving the mill by controlling the quantity of fuel entering the mill. The knife is set by hand, and feeder table speed is varied to proportion fuel to heat required. When direct current variable speed motors or adjustable speed alternating current motors of suitable design (standard slip ring motors are not suitable) are used for this service, the rate of feeder table speed or fuel feed is determined by positioning the motor control rheostat. Lever operated variable speed mechanical transmissions with constant speed drives also can be used, feeder table speed being set by the lever position.

Another type of fuel feed device consists of a spider that forms a series of pockets revolving around a shaft, each pocket discharging a given fuel

volume into the mill. In addition to drives mentioned above, this type of unit can be operated by a constant speed drive through a lever operated speed changer with free wheeling clutch or pawl and ratchet on the feeder shaft. Position of the lever determines rate of fuel feed to the mill, and therefore rate of pulverized fuel leaving the mill.

A pulverizer discharge damper and sometimes a recirculating damper are provided as part of the mill and may be automatically controlled simultaneously with the fuel feed. This arrangement assures proper primary air flow to the burner to obtain optimum conditions of mixture richness for best burner ignition and decreases effective time lag in the mill.

Some installations use constant speed feeder tables that are started and stopped automatically by a controller furnished as part of the mill. This controller is generally one of two types. One is actuated by fuel level in the mill and operates to maintain the level within close limits. The other measures the differential between primary air pressure drop due to flow of air and pressure drop across the grinding chamber in the mill. When fuel flow into the mill is controlled in this manner, automatic combustion controls have no direct jurisdiction over the fuel fed into the mill but rather govern pulverized fuel flow from the mill to the burners. This is accomplished by controlling the rate of primary air flow through the mill, and thus the rate of fuel flow, in accordance with the demand for heat.

Air Temperature Control

Generally, primary air to the mill is preheated and for best results the primary air or coal - air mixture temperature leaving the mill must be within established limits. This temperature can be controlled either automatically or manually by proportioning the quantities of preheated and tempering air. Too high a temperature may result in pulverizer difficulties and too low a temperature does not produce sufficient drying during pulverization.

Mill Pressure Control

Some types of mills are designed to operate under a pressure which may vary and need not be controlled. Other mills operate best when pressure in the mill is maintained at a slight negative value. When primary air is under natural draft or atmospheric pressure no control of mill pressure is required. However, in most cases primary air is taken from the forced draft duct, and pressure in this duct varies approximately as the square of the boiler load. Therefore, a primary air pressure controller or mill suction controller is used to maintain air pressure or suction to the mill at a constant value. Usually this is accomplished by regulating a primary air duct damper.

Primary Air Flow Control

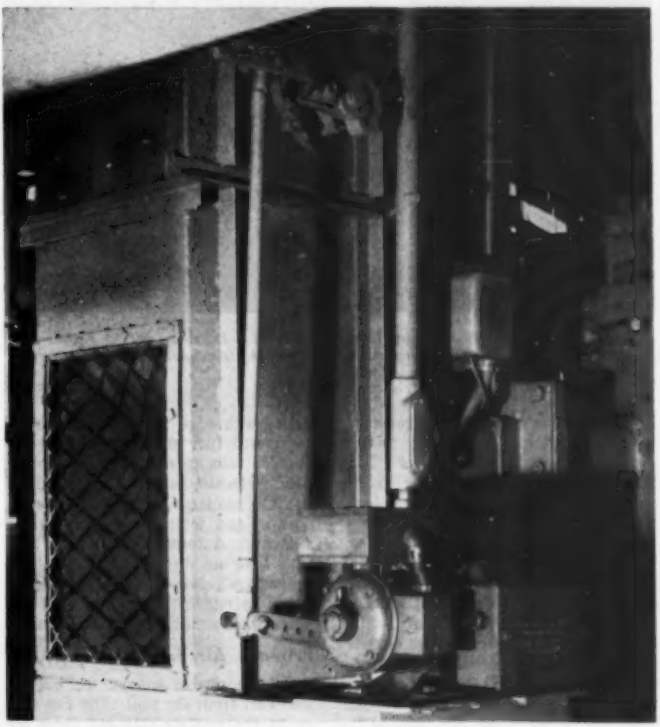
Primary air flow control is important with all types of mills. Although it is not a critical adjustment on that type of mill in which fuel flow rate is determined principally by fuel feed into the mill, it does favorably influence ignition characteristics and range of operation. A damper at either the inlet or outlet of the mill exhauster is operated simultaneously with the fuel feed control for regulation of primary air flow, with either the same or a parallel controller.

For mills where primary air flow rate determines pulverized fuel flow to the burners, control of primary air flow is very important. It must be accurately proportioned to both load on the boiler and the secondary air flow in order to maintain correct air-fuel ratio and maximum efficiency. Usually, the mill exhauster or blower operates at constant speed, and dampers are modulated for primary air control.

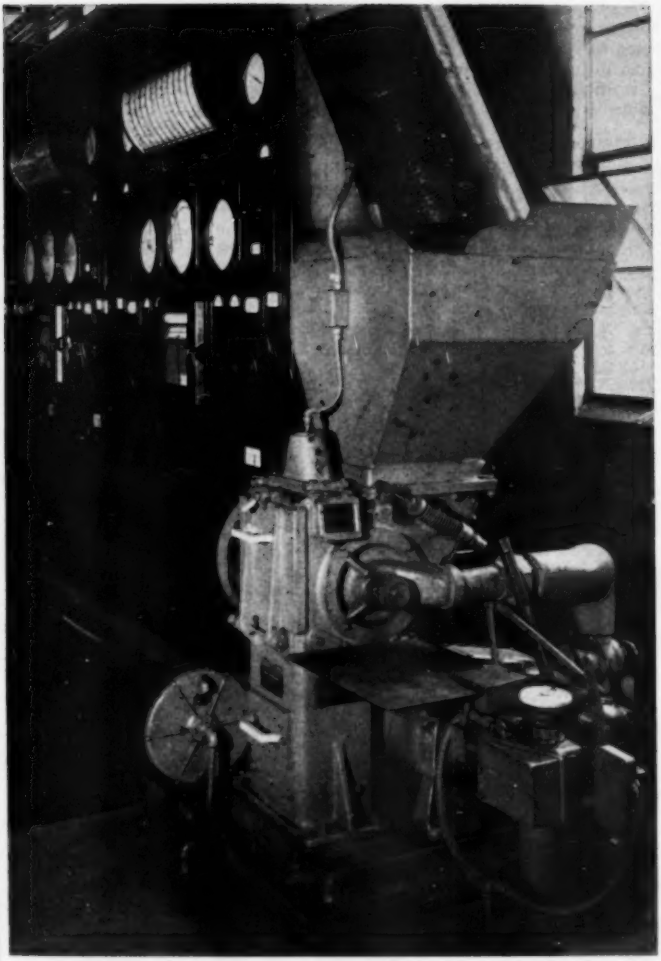
Methods of Pulverization

All types of pulverizers use one or more methods for reducing coal from the variable sizes in which it may be received to a powder of extreme fineness. The three most common methods for grinding or pulverizing fuel are: (a) RING ROLL method where the lump of fuel is crushed or ground between metal rollers or balls under spring pressure and a metallic grinding ring or race, (b) IMPACT method in which lump fuel is crushed by being struck as with a hammer or falling metal balls, and (c) ATTRITION method where lump fuel is reduced from a granular form to a powder by attrition or rubbing of the granular particles against each other or against rapidly moving, specially designed, parts of the pulverizer. The order in which the above methods are listed does not in any way indicate relative merits or value.

The various methods used have in themselves very little effect on the automatic combustion control system



Controlled amounts of tempering air are mixed with the preheated primary air to maintain coal-air mixture temperature within predetermined limits



When one boiler is fired by two pulverizers, it is necessary to totalize the two coal feeds to determine the amount of air needed for combustion

since the mills all run at a constant speed and are not connected to the automatic combustion controls. The more important factors are the methods used to control pulverized fuel flow to the burners.

Methods of Separation

Usually, the process of separating out fuel that has not been sufficiently well pulverized for satisfactory combustion is accomplished in one of two ways, namely: (a) mechanical separation where coarse fuel is thrown out of the stream of pulverized fuel by the revolving element of the mill as it leaves the last stage of grinding, and (b) classifier separation consisting of passages through which the stream of pulverized fuel must pass and be deflected, velocity reduction, and other such methods that will reject those particles too large for satisfactory combustion and return them for further reduction. Automatic combustion controls have no direct control over this function which is manually set and allowed to remain fixed until tests for fineness show adjustments are needed.

Primary Air Fans

Fans normally remove the pulverized fuel from the mill. The fan may be on the primary side and force air through the mill under pressure or on the outlet side and pull coal-air mixtures through the mill. In both cases, coal-air mixtures are conveyed through piping to the burners.

Burners

While several different types of pulverized fuel burners are available, the burner design does not affect the method of automatic combustion control employed. In fact, all adjustments provided at the burner are designed primarily for manual operation since they affect fuel-air distribution and flame character and not the ratio of air to fuel. In addition to the points of control mentioned in connection with the pulverizers, it is also necessary to control air for combustion and maintain constant furnace draft with a constant suction controller that positions the ID fan damper.

Method of Control

The exact method of automatic control selected will depend on the type of pulverizer, number of pulverizers, and characteristics of the auxiliaries. Fig. I illustrates a typical boiler efficiency compensated control system designed to control two ring roll type pulverizers and constant speed fans. This system features electrical transmission, adjustments for load distribution and fuel-air ratio, boiler base loading control, and remote manual control. One pulverizer or two pulverizers at equal or unequal ratings can be controlled automatically. In addition, automatic readjustment of fuel-air ratio by the boiler efficiency meter corrects for irregularities in fuel supply or quality. The master controller, either with proportional action or with proportional plus floating action, measures steam pressure. It electrically loads the primary air and fuel feed controllers which establish the load carried by the boiler.

Primary Air Controllers

Each primary air controller and its electric power unit operates an exhauster fan damper to regulate pulverized coal flow to the burner. The transmitting potentiometer for the controller is mounted on the master controller while the receiving potentiometer is adjusted by the exhauster fan damper power unit. A manually adjusted biasing potentiometer in the controller changes the ratio of coal flow to master controller loading, thereby changing load distribution in a multiple boiler system or division of load between pulverizers.

Fuel Feed Controllers

Each fuel feed controller adjusts a lever on the pulverizer feeder to proportion coal input to primary air. The

transmitting potentiometer is adjusted by the exhauster damper power unit and the receiving potentiometer is operated by the fuel feed power unit. A biasing potentiometer in the controller permits changing the ratio of coal feed to primary air flow.

Air Flow Controllers

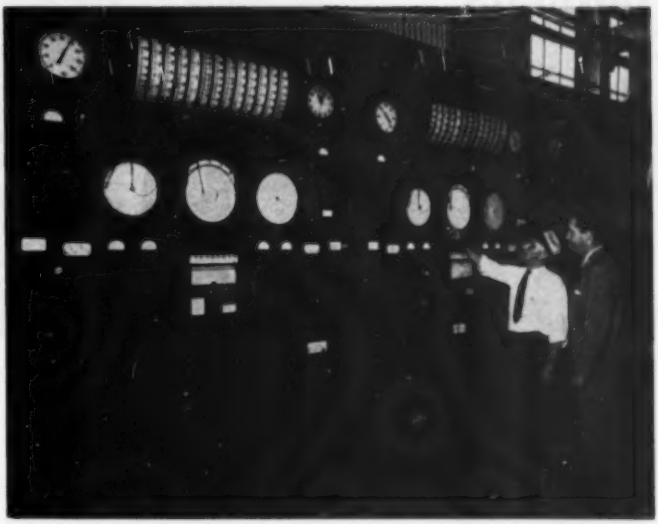
A totalizing air flow controller with its power unit controls the FD fan damper to proportion air flow to total fuel flow. Two transmitting potentiometers are a part of the controller. One potentiometer is adjusted by each primary air damper power unit and it establishes a voltage corresponding to damper position and coal flow. The sum of these voltages is balanced against the voltage on a potentiometer operated by the FD damper power unit. The FD damper position or air flow is proportional to total fuel flow with either or both pulverizers under automatic control. When a pulverizer is shut off, a resistance is cut out of the totalizing circuit to indicate zero rather than minimum coal flow on that particular pulverizer. The biasing potentiometer in the controller serves as either a manual or automatic fuel-air ratio adjustment for the system.

Efficiency Correction

With the boiler efficiency meter, proper combustion conditions exist when air flow and steam flow pens are recording the same value on the chart. If the pens separate, indicating a change in combustion efficiency, the controller acts on the fuel-air ratio adjustment in the totalizing controller until the two pens have assumed like positions and the controller set point has been reached.

Safety Interlocks

In addition to the basic controllers shown, additional equipment can be provided to: (a) limit fuel and air input to the available draft, (b) limit fuel input to the available air, and (c) shut off fuel if the limiting action is ineffective after a definite time interval. Manual to automatic transfer switches can be interlocked to necessitate a definite sequence of transferring power units from manual to automatic control. Additional interlocks for starting up are available.



At the installation shown in this photo, all instruments and controllers are consolidated on one large control panel located on the firing floor

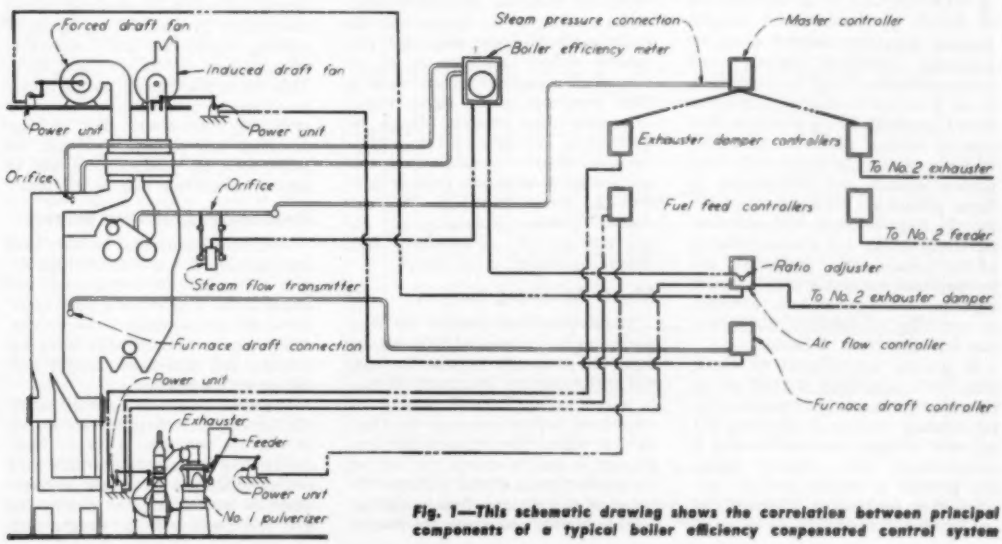
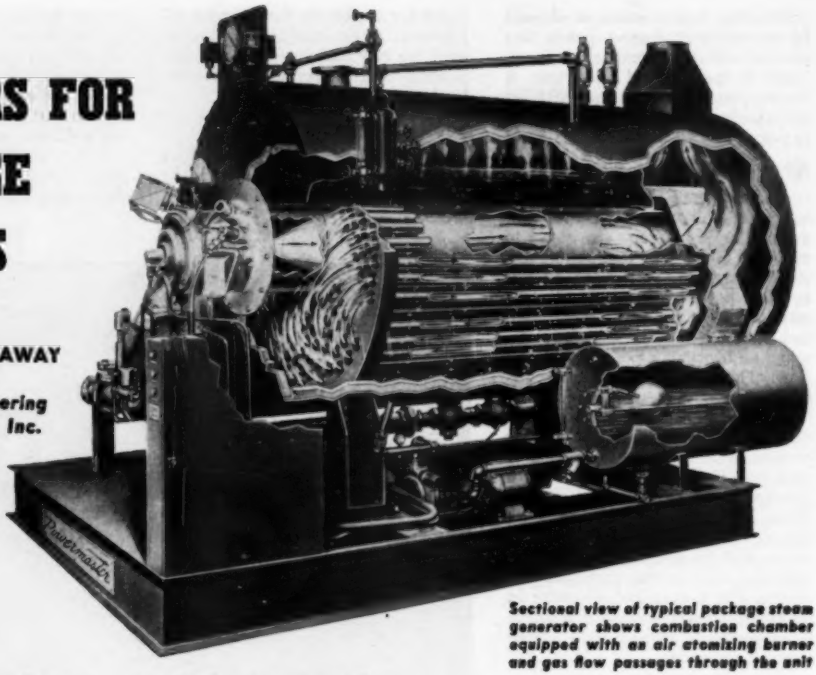


Fig. 1—This schematic drawing shows the correlation between principal components of a typical boiler efficiency compensated control system

BURNERS FOR PACKAGE BOILERS

GEORGE H. GARRAWAY
Vice-President in Charge of Engineering
Orr & Sembower, Inc.



Sectional view of typical package steam generator shows combustion chamber equipped with an air atomizing burner and gas flow passages through the unit

Burning liquid fuels, particularly heavy residual oils, efficiently in the confined integral furnace of modified Scotch type boilers imposes numerous firing restrictions. Here are the characteristics of the various burners available for this service

INTRODUCTION of the modified Scotch type boiler with integral furnace, popularly referred to as the automatic multipass package unit where combustion must be accomplished in a confined chamber, has presented numerous firing problems. Any type of burner performs reasonably well on conventional boilers with large firebox volume, and deficiencies in flame pattern are not a serious handicap. In large furnaces with extensive refractory lining and checkerboarding of the furnace floor, combustion can be completed without extensive carbon deposits. Package boilers, however, do not offer a favorable firing condition for many types of burners.

In general, any efficient oil burner must: (a) thoroughly atomize oil of all commercially available grades without drooling, fouling, or clogging, (b) maintain uniform atomization over a comparatively wide capacity range, (c) provide a perfect mixture and satisfactory pattern of atomized oil and incoming combustion air to assure rapid and complete combustion within the confines of the furnace over the entire range of firing rates, and (d) operate without impingement of unburned oil upon cold furnace walls in close proximity to the flame origin. To satisfy these essential design requirements, four basic oil burner types are available for consideration and application to automatic package boilers: (a) steam atomizing, (b) mechanical pressure atomizing, (c) rotary cup, and (d) air atomizing. Each design is discussed in this article.

Steam Atomizing Burners

Steam atomizing burners are relatively simple, and several different designs are extremely popular for central station service. Steam and oil may be mixed in an internal plenum arrangement before entering the furnace or steam flow through the nozzle may be used to entrain the fuel oil for combustion in several different external mixing designs. Because the extremely high pressure required for the mechanical pressure atomizing burner is eliminated, the flame shape is easily controlled. Commercially available steam atomizing burners have been developed into highly efficient units over a wide range of firing rates. Tests show such burners quite applicable to package units. However, a continuous supply of steam is required which necessitates the use of supplemental starting equipment until atomizing steam is produced by the boiler itself. This restriction caused manufacturers to eliminate consideration of steam atomizing burners and they are not found on any package type unit. As larger units are produced and used in battery, revaluation may be in order.

Mechanical Atomizing Burners

Mechanical atomizing burners have been developed to a relatively high degree, particularly for distillate oils and steady loads. This restricts their application for use on large package units, which require complete flexibility for frequent and wide load changes with oils up to No. 6 residual.

In central station boilers with multiple burners, individual burners are cut in and out with load changes. Nozzles also can be changed to follow load swings coming at infrequent intervals which do not fluctuate too widely. But it is still possible to get caught with

small nozzles in the burners at a time of rapidly increasing load.

Wide range pressure atomizing burners (Navy type) meet these objections by operating at very high oil pressure up to or in excess of 300 psig utilizing a compound atomizing orifice at the nozzle tip. Reduced ratings are obtained by varying the amount of oil returned to the pump suction or storage from between the first orifice and that leading to the combustion chamber. Such burners have an excellent turndown ratio, some in excess of 20 to 1. However, tests have indicated deficiencies in establishment of flame pattern when used with package units resulting in raw oil deposits and carbon buildup on combustion chamber walls, even without approaching minimum excess air range.

Limited clearances that need frequent cleaning also are objectionable from the standpoint of the small plant operator, particularly when burning heavy Bunker C fuel. The combination of oil temperature of approximately 200 F required for heavy oils to insure proper atomization and high oil pressure demand more complex accessory equipment and service thereof than is necessary with other types of burners.

Rotary Cup Burners

In rotary cup burners, atomization is accomplished by spinning a film of oil off the lip of a high speed cup rotating at 4000 to 5000 rpm which results in a projection of relatively large globules of oil into the combustion chamber. In order to accomplish further atomization of the oil, it is necessary to introduce a blast of high velocity secondary air out past the air nozzle of the burner to further break down the globules of oil and permit reasonable combustion. Usually incandescent furnace refractory lining is required as an aid to combustion.

Rotary cup burners have many mechanical parts that must be set accurately to obtain satisfactory operating conditions. Frequent breaking away of the coke which tends to form on the combustion walls is necessary when the burner is not properly adjusted. Such adjustment on a rotary cup type burner is quite sensitive, particularly with viscosity or temperature changes.

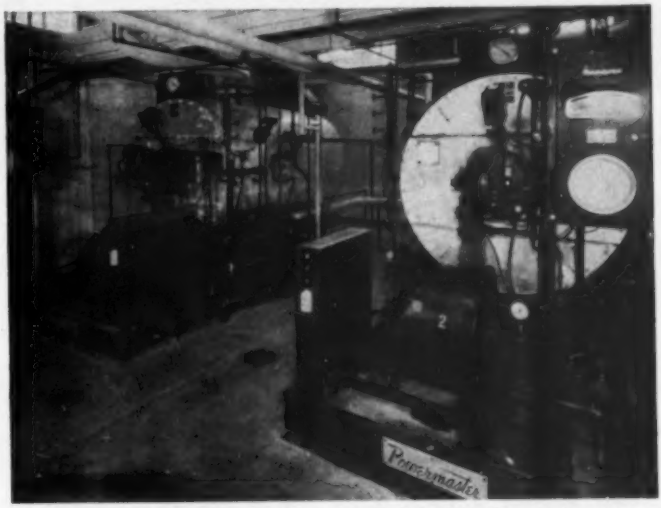
Since the rotating cup is dependent somewhat upon the blast of secondary air for final atomization, it is difficult to accomplish extensive modulation without serious loss of efficiency in the package unit. Some designs have a tendency to drip oil from the cup after the burner is shut off, particularly with a new supply of oil at slightly different viscosity or when preheat temperature is not maintained at a close level for which the burner has been adjusted.

Air Atomizing Burners

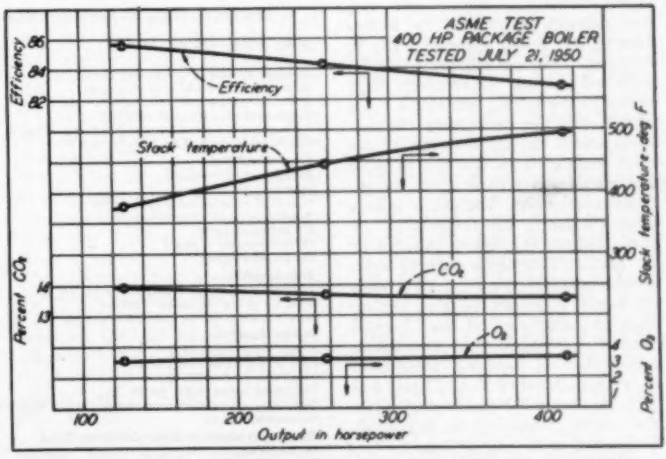
In central station practice, air atomizing burners have not been too widely used, presumably due to the necessity for a compressed air source. The cost of compressed air for atomization compares with the cost of steam lost in a steam atomizing burner or the power needed for pressure atomizing.

On the other hand, air atomizing burners have been developed so as to be very adaptable to the integral furnace of automatic package boilers. Although one of the first methods to be used for firing liquid fuels, air atomization was never adequately perfected in the early stages of burner development with the result that the rotary cup and mechanical pressure atomizing burners gained a wider and more rapid acceptance.

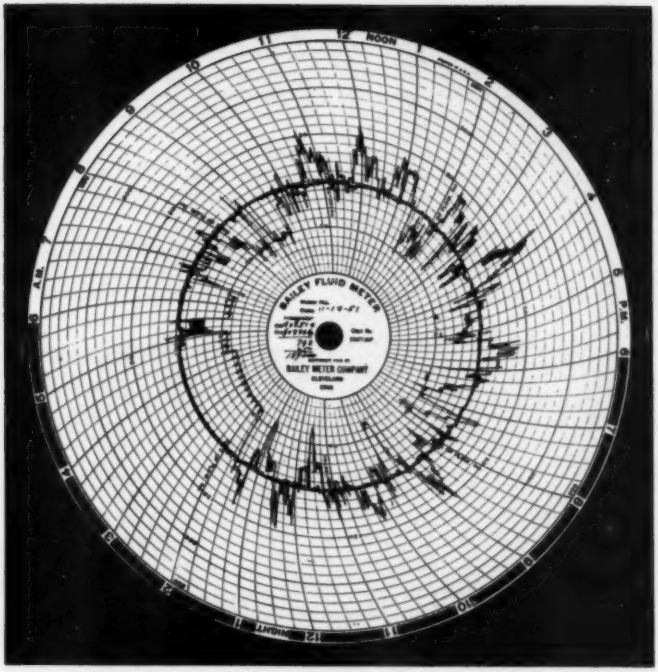
Performance of all types of oil burners is greatly influenced by the manner in which air is supplied to the atomized fuel to secure thorough mixing. This air control system is complex and critical with both rotary cup and mechanical pressure atomizing burner



Rotary cup burners, shown in this photo of two 100 hp units, atomize oil by spinning it off the lip of a high speed cup rotating at 4000 to 5000 rpm



Typical test record of package boiler indicates efficiencies of 83 to 85½ per cent, stack temperature of 375 to 490 F, and CO_2 of 13½ to 14 per cent



Air atomizing burner performance chart shows constant 100 psig pressure during load swings of 3000 to 19,000 lb per hr

designs. Air supply is simplified with steam and air atomizing burners because of lower pressures and therefore less critical tolerances. The simplicity of construction and ease of removal of the air atomizing nozzle make it particularly adaptable to gas-oil combination burner design.

In air atomizing burners, oil flow meets air jets within the core of the nozzle pulverizing the oil into very fine particles surrounded by a thin film of air, which apparently acts as kindling. This air and oil emulsion, delivered through the relatively large orifice of the nozzle, introduces a fog of oil into the combustion chamber in a pattern quickly absorbed by the main combustion air. It is easy to ignite and provides effectively clean and efficient combustion. The nozzle is kept clean constantly by compressed air flow through the inside passages of the nozzle. Time delay controls operate the atomizing air compressor after the burner shuts off, purging any remaining particles of oil from internal parts of the nozzle. Air atomization permits low oil pumping pressures in the neighborhood of 15 to 25 psig and gives less cause for maintenance from this source. Atomizing air is normally supplied at 15 psig or less.

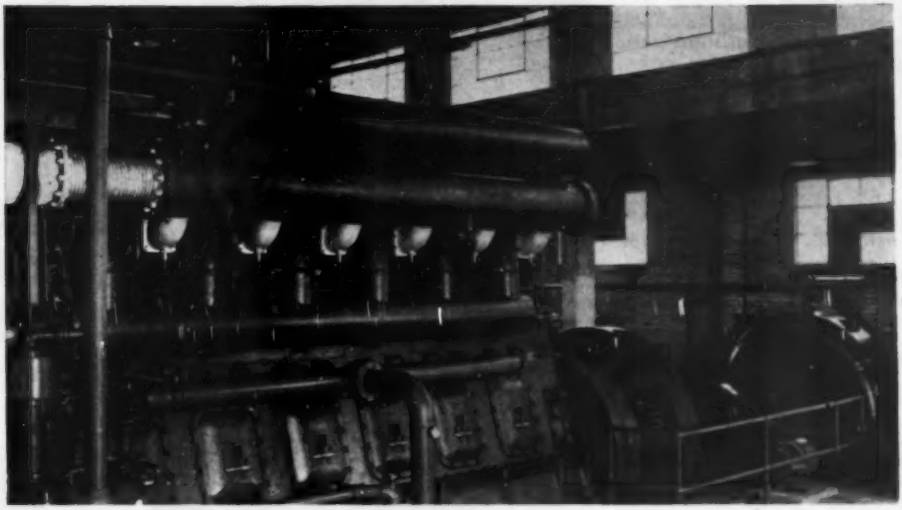
As atomization is accomplished entirely by the nozzle-carried compressed air, and is not dependent on the main combustion air for anything but pattern, turndown is accomplished at constant combustion efficiency. Combustion air velocity and forced draft fan horsepower requirements are less.

In air atomizing arrangements, oil flows through the circulating system until programming controls cause a three way air solenoid valve to open and admit compressed air to the piston operating chamber of the circulating oil valve attached to the nozzle tube itself. The compressed air forces the piston to move inward closing the return oil line port and opening the burner inlet port. Oil then passes through the center tube of the concentric pair to and through the atomizing nozzle where it contacts atomizing air from the compressor. Atomizing air supply to the nozzle assembly is continuous as long as the fuel pump operates, since air compressor and fuel pump are driven by the same motor. The compressed air atomizes the oil into a fine fog which is directed into the combustion chamber where it contacts the pilot flame and is ignited thus establishing the main flame.

The flame pattern of air atomizing burners has been found to be excellent for package boilers with cylindrical furnace as the likelihood of oil particle impingement on the combustion tube walls is negligible. The flame is solid and strongly established very close to the burner. Combustion is sufficiently rapid and complete to have the flame disappear about two-thirds down the cylindrical combustion tube. Air atomizing nozzles can burn all grades of fuel oil from No. 2 to the heaviest No. 6 Bunker C grades by simple external adjustments of oil pressure and oil flow controls.

RESULTS OF TESTS ON PACKAGE STEAM GENERATOR WITH AIR ATOMIZING BURNER

Boiler rating—400 hp	***Heating surface—1808 sq ft***		
Average Pressures and Temperatures			
Steam pressure in boiler drum — psia	116.1	115.2	115.2
Water temperature entering boiler — deg F	75	73	73.3
Steam quality — per cent moisture	0.375	0.25	0.32
Air temperature around boiler (ambient) — deg F	85.97	78.5	81.94
Gas temperature leaving boiler — deg F	496.6	447.4	380
Total Quantities			
Duration of test — hours	4.0447	4.0594	4.0628
Pounds of No. 6 oil burned	3693.5	2289	1106
Pounds of water actually evaporated	48,809.8	30,628.2	15,067.5
Heating value of oil — Btu per lb	18,212	18,212	18,212
Oil pressure — psig	27	23.25	28.5
Oil temperature — deg F	188.8	188	195.4
Air pressure — psig	15.2	13.2	10.8
Unit Quantities			
Enthalpy in steam above quality — Btu per lb	1186.5	1187.5	1186.9
Enthalpy in feed to boiler — Btu per lb	43	41	41.3
Heat absorbed per lb of steam — Btu per lb	1143.5	1146.5	1145.6
Hourly Quantities			
Actual water evaporated — lb per hr	12,067.59	7545	3708.64
Rate of fuel firing — lb per hr	913.17	563.88	272.23
Total heat input — Btu per hr	16,630,650	10,269,400	4,957,850
Total heat output — Btu per hr	13,799,289	8,650,300	4,248,600
Equivalent evaporation from and at 212 F — lb per hr	14,223.1	8916	4379.1
Horsepower output	412.23	258.4	126.9
Flue Gas Analysis at Boiler Outlet by Orsat			
Per cent CO_2	13.61	13.72	13.94
Per cent O_2	3.47	3.36	3.1
Per cent CO	0	0	0
Per cent efficiency	82.97	84.23	85.69



This 820 hp natural gas burning diesel operates on 5 to 10 per cent pilot fuel oil injected on the compression stroke

PRIME MOVERS PERFORM DUAL DUTY

Confronted with replacing obsolete generating and pumping equipment, the State of Louisiana investigated the purchasing of electrical power and cost of installing prime movers to generate power and handle water from the Mississippi. They decided on the latter

THOMAS C. DAVID, ***Partner***
Pan American Engineers

LOUISIANA State Penitentiary, Angola, La., has recently completed an unique installation that has the same prime movers for drainage and electrical power generation. So far as is known, this is the only installation of this kind anywhere.

Due to obsolescences, the penitentiary was faced with the problem of replacing the steam driven drainage pumps and diesel engine driven generator. The situation was first studied from the angle of purchasing power to operate electrical motor driven drainage pumps and to supply power for distribution at the Penitentiary. However, the first cost of the power supply line, which would have to be constructed across the Mississippi River, and the demand charge for the large motors that would be required to stand idle until certain seasons of the year combined to make this solution uneconomical.

Another factor controlling the study was the fact that the State was constructing a natural gas supply line into the penal farm, and they planned to burn gas instead of oil as the main industrial fuel. This provided a chance to use the favorably priced natural gas for the prime movers, as well as for other institutional utilization.

When the installation was made, natural gas as a fuel in large diesel engines provided several thousands of dollars a year savings over fuel oil. At the present time there seems to be no future change in this price structure, and diesel oil may never again be as cheap as natural gas, compared on a usable Btu value.

Replacement of the diesel engine and generator was an item of critical importance because the engine was very old and unreliable. The stand-by electrical power was from small diesels, located in the ice plant, and they were only capable of supplying the barest essentials of the lighting load. The original engine housing was in fair shape but only large enough for one small engine. The problem of removing the old foundation to accommodate new and larger equipment was evaluated against attempting to enlarge the old sheet metal power plant building.

Of necessity, the new drainage pumps were placed near the old pump station at a point where the main drainage culvert with flood gate crossed under the Mississippi River levee. Unfortunately, this was several miles from the old power plant site. Drainage and electrical generation facilities were therefore combined, and a new concrete building was constructed, supported on piling, adjacent to the flood gate culvert to accommodate both drainage pumps and electrical generators.

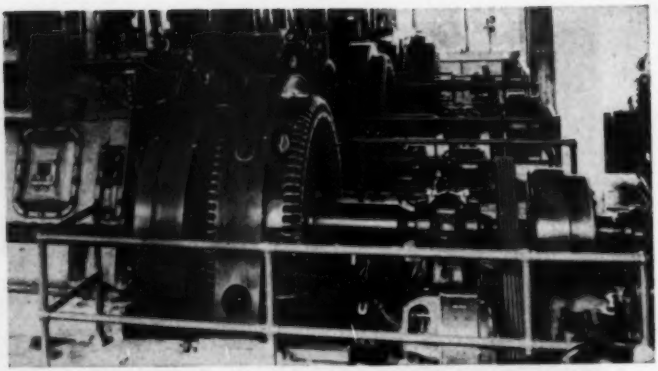
Two 60,000 gpm mixed-flow horizontal pumps were installed, each discharging over the levee through a 54 in. steep pipe with 66 in. flap gate at discharge end. The plant has two 820 and one 615 hp dual-fuel engines. The smaller engine drives a generator on the same shaft in the conventional manner. Both larger engines have extended shafts connected to a pump through a large air coupling. This flexible coupling is similar to a brake shoe and drum, and compressed air inflates the expanding lining to apply the connective pressure.

Engines operate on natural gas, fired by the injection of a small amount of diesel fuel oil at the critical point of the compression stroke of each cylinder. Amount of pilot fuel varies from 5 to 10 per cent of the diesel fuel oil required to operate the engine when running on the oil cycle. In the event of gas supply failure, a control mechanism automatically cuts in fuel oil to carry the complete load.

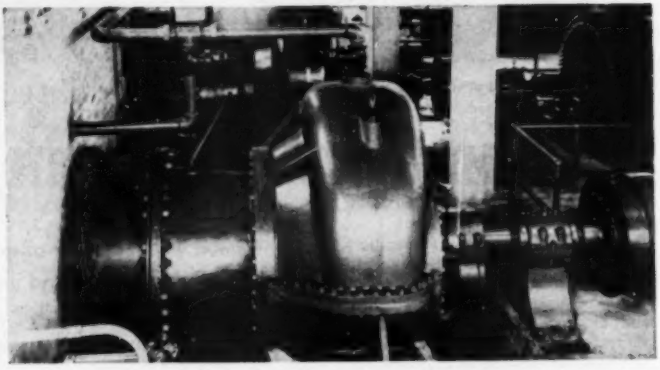
Pump intake is through welded steel pipe flared suction bells, supported on piling, and the sump area sides and bottom are set in concrete to prevent erosion and mud suction. The intake is protected with a metal screen supported on piling.

Major pumping loads usually occur in the spring of the year when the Mississippi River stages are high, and the drainage flood gates have to be closed to prevent the river from backing into the farm area. At low river stages the flood gates are opened and drainage is by gravity. When pumping is required the two larger engines are available with a slight reduction in electric power generation. The smaller unit serves only for electric generation.

The plant is equipped with a new switchboard, evaporative coolers to cool the engine jacket water, air compressors, overhead traveling crane, fuel oil pumps, lube oil pumps, water pumps and vacuum priming pump. A service transformer bank, air intake filters, exhaust snubbers, fuel oil and compressed air tanks, natural gas supply piping and regulators are located on the outside.



All electrical power, for the penitentiary, is supplied by these generators. Individual V-belt driven exciters furnish direct current to the field windings



One of the two 60,000 gpm mixed-flow pumps that discharges backup water over the levee walls during the flooding stages of the Mississippi River

NEOPRENE COATINGS

SYNTHETIC RUBBER, neoprene, is familiar enough as an interior lining, either as sheet lining for chemical tanks or as heat-cured brushed coatings for complex shapes like pump and valve interiors. But most corrosion engineers are not yet aware that neoprene is now produced in a form that makes it eligible for maintenance work—for the exterior of tanks, process equipment, structural steel, pipelines and the like. The new material is intended for protection against splash, spill and corrosive fumes and atmospheres.

These coatings are the result of two developments: first, a slightly modified neoprene polymer which, before vulcanization, produces solvent solutions of low viscosity per unit of solids content; and second, accelerators, which will cure this polymer at room temperature. Main ingredients are an aromatic solvent, carbon black, neoprene and a separately added accelerator.

This film has a resistance to acids, alkalis, oils, most hydrocarbons, and highly important, to sunlight and weather. It is tough and rubbery, and its resilient qualities are inherent. Solids content is 60-70 per cent, giving a thick film per coat. The coating cures at room temperature in 24 to 48 hr by adding an accelerator at the time of application. A second coat may be applied after two or three hours without danger of brushing up the first.

In applying, the user must stir a few ounces of accelerator into each gallon of material. After acceleration, pot life is 12 to 36 hr, depending on amount of accelerator used.

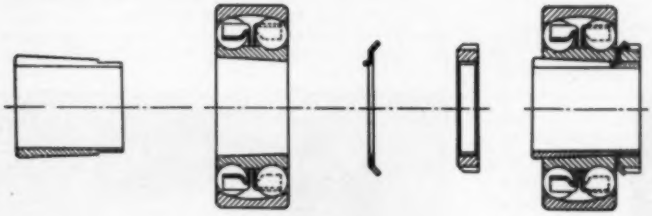
Power transmission

Engineering data and information to aid in selection, application and operation of equipment used in transmission of mechanical power

BEARING TYPES AND THEIR FUNCTIONS

JOSEPH L. BRUSCA, Sr, *Design Engineer*
SKF Industries, Inc.

Industry now has a wide variety of bearings from which to choose. Each bearing type has characteristics which make it the best choice for a certain application. The original bearing selection in a machine was made to assure maximum performance. Therefore, replacement should be made with the same type bearing. The following resume of the functions of each bearing type will aid the engineer to better assist himself in this selection



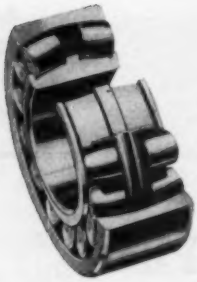
When shaft and housing sizes do not meet the dimensions of a standard bearing, a special adapter bearing can be chosen. This unit consists of a sleeve, tapered bore bearing, lockwasher, and locknut, all assembled into one adapter mounting.

Self-aligning ball bearings, with two rows of balls rolling on a spherical surface of the outer ring, compensates for angular misalignment resulting from errors in mounting, shaft deflection and foundation distortion. These bearings will not exert bending influence on the shaft. This is an important consideration in applications requiring extreme accuracy at high speeds. They are recommended for radial and moderate thrust loads in either direction.

Single row, deep groove ball bearings will sustain, in addition to radial load, a substantial thrust load in either direction, even at very high speeds. This advantage results from the intimate contact that exists between the balls and the deep, continuous groove in each ring. When installing this type of bearing, careful alignment between the shaft and housing is essential. This bearing is also available with seals, which serve to exclude dirt and retain lubricant.

Angular contact ball bearings support a heavy thrust load in one direction that is sometimes combined with a moderate radial load. A steep contact angle, that assures the highest thrust capacity and axial rigidity, is obtained by a high thrust supporting shoulder on the inner ring and a similar high shoulder on the opposite side of the outer ring. These bearings can be mounted singly and in tandem for constant thrust in one direction when flush ground.

Double row, deep groove ball bearings embody the same principal of design as the single row bearing. However, the grooves for the two rows of balls are so positioned that the load lines through the balls have an outwardly converging contact angle. This bearing has a lower axial displacement than occurs in the single row design, substantial thrust capacity in either direction and high radial capacity because of the two rows of balls.

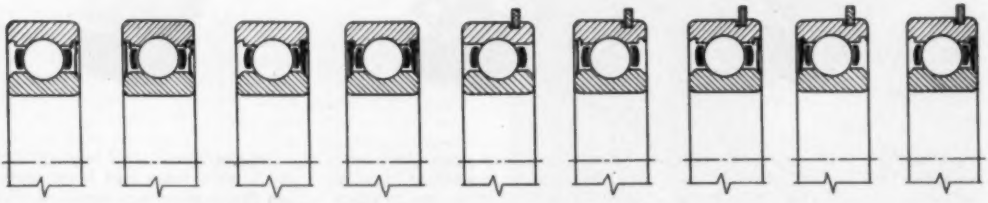


Spherical roller bearings have an unexcelled capacity resulting from the number, size and shape of the rollers and accuracy through which they are guided. They are inherently self-aligning and angular misalignment between the shaft and housing has no detrimental effect. For this reason, the full capacity is always available for useful work. Design and proportion are such that, in addition to radial load, heavy thrusts are carried in either direction.

Cylindrical roller bearings have high radial capacity and provide accurate guiding of the rollers, resulting in a close approach to true rolling. Consequent low friction permits operation at high speed. Flanged types, with only one ring, allow a limited free axial movement of the shaft in relation to the housing. They are easy to dismount even when both rings are mounted with a tight fit. The double row type assures maximum radial rigidity and is particularly suitable for machine tool spindles.

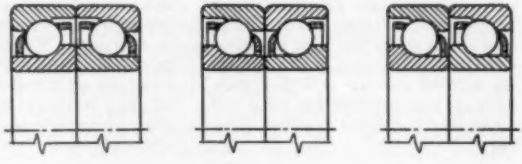
Spherical roller thrust bearings are designed to carry heavy thrust loads or combined loads that are predominantly thrust. A single row of rollers roll on a spherical outer race with full self-alignment. The cage, centered by an inner ring sleeve, is constructed so lubricant is pumped directly against a high guide inner ring flange. This insures lubrication between roller ends and guide flange.

Ball thrust bearings are designed for thrust load in one direction only. The load line through the balls is parallel to the axis of the shaft. This results in high thrust capacity and the minimum axial deflection. Flat seats are preferred, particularly where the load is heavy, or when close axial positioning of the shaft is essential. A good example of this would be a machine tool spindle.



Bearings can be fitted with permanent self-supported seals or closures to prevent entrance of foreign matter, which would cause wear and destroy accuracy.

Angular duplex bearings when tightly clamped become in effect a preloaded double row bearing. Mounting can be face-to-face, back-to-back, or tandem.



DEFENSE PLANT DE-MOTHBALLED FAST WITH THE HELP OF TWO SUN PRODUCTS

BEFORE: The machinery in this Navy-owned shell-making plant stood idle—coated with a rust preventive—for 5 years after World War II. When asked to reactivate the plant in three months, the U. S. Hoffman Machinery Corporation anticipated a complete machinery teardown for cleaning, because the rust preventive had seeped into the working parts.

AFTER: No teardown was needed. Sun Spirits did the external cleaning job and the detergency of Sunvis H.D. 700 Oils the internal job—cleaning out parts and freeing hydraulic systems. Thanks to the effectiveness of these products, the job was completed and the plant put in operating condition within the three months specified by the Navy.

Recently the U. S. Hoffman Machinery Corporation was asked to reopen a World War II Navy-owned shell-making plant and start production in three months. The machinery, idle for 5 years, had been protected by an external layer of rust preventive. Headstocks, gear units and hydraulic lines were among the parts coated, and unfortunately some of the protective material had seeped into them. It looked as if the machinery might have to be torn down to be cleaned.

Hoffman invited Sun and several other oil companies to survey the machinery and suggest cleaning methods. The company chose Sun's recommendations on the basis of their soundness, as well as on Sun's record for reliable service in other Hoffman plants. The Sun products used eliminated the need for any dismantling. Sun Spirits did the external cleaning job. Sunvis H.D. 700 Oils freed up the hydraulic systems, many of which were extremely sluggish; the detergency of these oils flushed away every last trace of sludge and rust preventive.

Throughout the entire cleaning and recharging process, Sun representatives stayed on the job. As part of Sun's regular service, they trained the oilers, helped work out an inventory control system, and set up lubrication schedules. The terms of the Navy contract were met, and vital defense production was started on schedule. In the year and a half that has since elapsed, there have been no machine failures traceable to poor lubrication.

SUN OIL COMPANY, Dept. IP-10
Philadelphia 3, Pa.

☐ I would like to consult with a Sun representative.

☐ Please send me a copy of "Sunvis H.D. 700 Oils."

Name_____

Title_____

Company_____

Address_____

City_____ Zone_____ State_____

TECHNICAL ASSISTANCE AVAILABLE. Sun's engineers are at your service for consultation on any matters concerning hydraulics, lubrication or metalworking. It will pay you to utilize the broad experience they have gained in solving a wide variety of lubricating and processing problems in many different industries.

SUN INDUSTRIAL PRODUCTS

SUN OIL COMPANY, PHILADELPHIA 3, PA. • SUN OIL COMPANY, LTD., TORONTO AND MONTREAL

SUNOCO®

I-T-E announces 4 new circuit breakers

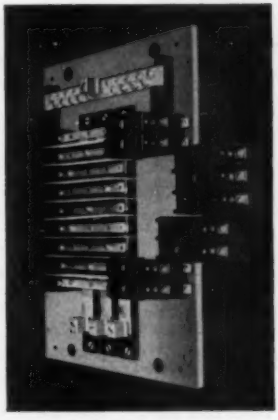
Conference following announcement of four new I-T-E panelboard circuit breaker designs. J. E. Kleinfelder, left, Sales Manager of the Small Air Circuit Breaker Division, listens as W. H. Edmunds, Engineer in Charge, explains the operating advantages of externally-adjustable instantaneous trip feature. Each of the four new breakers was designed specifically to improve construction and operation of panelboard and load center assemblies.

SAVES SPACE

Both I-T-E breakers are rated 225 amperes. New "J" frame, right, is 4½ inches shorter than present "K" frame. Benefits of this new design will be reflected in compact distribution-type panelboards and combination motor starter enclosures.

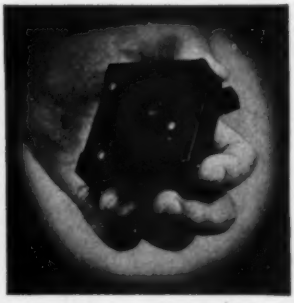
DOUBLES CAPACITY

Small lighting and distribution-type panelboard construction, previously limited to 50 ampere breaker capacity, may now incorporate 100 ampere branch circuits. New I-T-E "E" frame breaker, left, now has the same capacity as the "F" frame breaker shown above. New "E" frame will be advantageously applied up to 250 volts a-c wherever space conservation is required.



FIRST 2- AND 3-POLE EQ

New multipole EQ-type breakers are exact multiples of present single-pole design. Any given number of poles take the same space in panelboard. No tie-bar arrangements are necessary; all poles operate on common trip.



TINY, NEW EQP

This small, new single-pole EQP breaker now provides more compact plug-in lighting panelboards with all the features of I-T-E quality construction.

YOU STAY YEARS AHEAD WHEN YOU SPECIFY...

LOOK FOR RADICAL IMPROVEMENTS IN PANELBOARD AND LOAD CENTER DESIGN

Sweeping new improvements in the construction and reliability of future panelboards and load centers can now be expected, with introduction of four new circuit breaker designs developed by the I-T-E Circuit Breaker Company.

Three of the new units are advanced modifications of proved I-T-E designs in the 50, 100, and 225 ampere ratings. The fourth unit, a new, smaller addition to the present line of I-T-E molded case circuit breakers, is specifically designed for use in lighting panelboard and load center applications.

MORE COMPACT DISTRIBUTION-TYPE PANELBOARDS

Panelboards housing two 225 ampere breakers are shortened 9 inches, as result of a 4½-inch decrease in height of the present I-T-E "K" frame breaker. This size reduction now makes it possible to double-butt two of these new, short "J" frame breakers in the same vertical space formerly required for the one larger unit. The width of one whole breaker (9 inches) is saved.

SMALLER COMBINATION STARTERS

Motor-starting-equipment enclosures, using a circuit breaker in combination, can now be reduced as much as 4½ inches in height. I-T-E 225 and 100 ampere breakers have been shortened accordingly, without sacrificing electrical clearances or current-carrying capacities.

NOW...LIGHTING- AND DISTRIBUTION-TYPE PANELBOARDS UP TO 100 AMPERES

Where combination lighting and power panelboards were formerly limited to 50 ampere branch circuit ratings, the same type panelboard can now be obtained with 100 ampere capacity branch circuits. Redesign of the I-T-E "E" frame breaker doubles its current rating to 100 amperes at 250 volts a-c.

Also included in this "E" frame revision are 15 and 20 ampere ratings for fluorescent lighting applications at 277 volts a-c.

SIMPLIFIED MULTIPOLE PANELBOARDS

Compactness of multipole 50 ampere panelboards is improved and installation simplified through use of the new I-T-E two- and three-pole EQ breakers. First of their type available anywhere, these new multipole breakers fit all existing panelboard and load center designs in which single-pole breakers were formerly used. No tie-bar arrangements are necessary; all poles operate on common trip.

SMALLER PLUG-IN TYPE LIGHTING PANELBOARDS

Compact lighting panelboards and load centers for residential and commercial service can now incorporate all the advantages of I-T-E quality circuit breaker protection. The new, small I-T-E single-pole EQP design which makes this possible provides quick-make, quick-break operation and convenient plug-in feature.

ONE MANUFACTURER'S BREAKERS THROUGHOUT

Plant and operating engineers, electrical contractors, and electricians desiring uniformity of construction and components throughout their secondary distribution systems can now specify the largest variety of molded case circuit breakers for all applications up to 600 amperes, 600 volts a-c, 250 volts d-c. Frame sizes and types are available to suit any residential, commercial, or industrial requirement.

Standardize on I-T-E circuit breakers to assure service continuity, simplified maintenance, a single source for system expansion or replacements, and—*always*—the same, proved I-T-E dependability throughout.

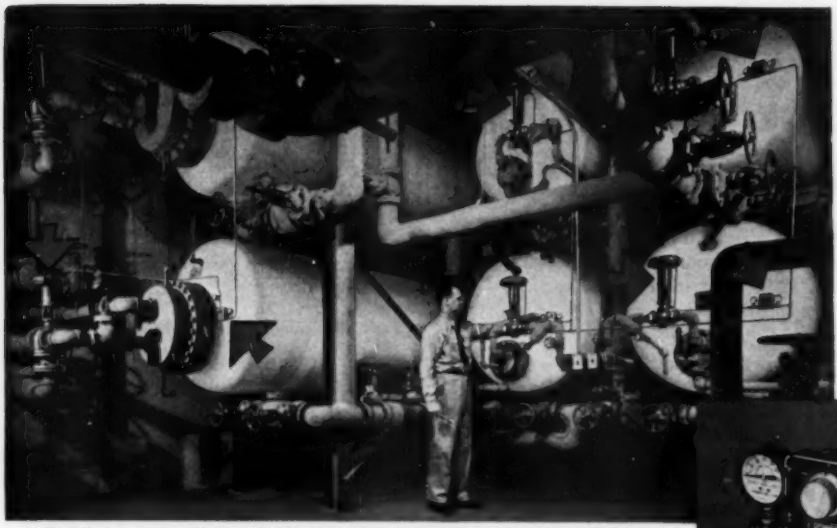
FULL DETAILS AVAILABLE FROM YOUR LOCAL PANELBOARD BUILDER

I-T-E

MOLDED CASE CIRCUIT BREAKERS

I-T-E CIRCUIT BREAKER COMPANY • 19TH AND HAMILTON STS. • PHILADELPHIA 30, PA.

Canadian Mfg. and Sales: Eastern Power Devices, Ltd., Toronto • Export Sales: Philips Export Corp., N.Y. 17, N.Y.



WATER HEATERS AT LEVER HOUSE New York City

Architects: Skidmore, Owings & Merrill

Consulting Engineers: Jaros, Baum & Bolles

Contractor: Gilliman-Rous-Pesce Corp.

LUX TOILET SOAP

One of Lever Brothers Co. Famous Soaps

Chief Engineer Edward MacDonald states "Performance of Powers Accritem Temperature Regulators has been highly satisfactory on the 6 water heaters shown above as well as on booster heater for dishwasher and for controlling cooling of condensate before discharge to sewer."

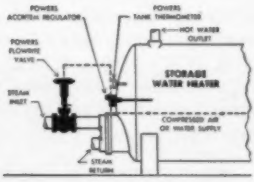
Powers ACCRITEM Regulator

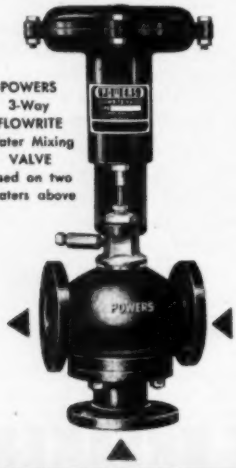
POWERS WATER TEMPERATURE CONTROL

ACCRITEM Regulators were selected for LEVER BROTHERS beautiful modern building on Park Avenue in New York City. The air conditioning system here is also Powers controlled.

Water heaters in more and more prominent buildings are being equipped with Powers Accritem Regulators because of their —

Unsurpassed for reliability and power to operate large or small diaphragm valves controlling Water Heaters, Heat Exchangers, Jacket Water Cooling for Diesel Engines or Air Compressors and many Industrial Processes.





POWERS 3-Way FLOWRITE Water Mixing VALVE Used on two heaters above

Important Features that Give Better Control and Lower Maintenance

- ***Adjustable Sensitivity*** and over-heat protection.
- ***Calibrated Dial*** temperature adjustment.
- ***Simple, Rugged Construction*** withstands vibration and insures years of reliable service.
- ***Temperature Ranges*** 50-250° F. and 150-350° F.
- ***Easy to Install.*** Requires 15 lb. supply of compressed air or water for its operation.
- ***Small Size***—regulator head is only 2⅞" x 3⅜", sensitive bulb is 12" long with ½" I. P. S. connection.

Bulletin 316 gives full details

Call Powers for aid with your problems of temperature control. Our more than 60 years of experience may be helpful to you. Whether you want a simple self-operated regulator or thermostatic water mixing valve or a pneumatic control system with recording controllers. . . .contact Powers.

POWERS Single Seat FLOWRITE VALVE Used on 4 heaters above

THE POWERS REGULATOR COMPANY

Skokie, Ill. • Offices in Over 50 Cities, See your phone book • Established 1891

(a91)

Handbook for engineered plant services

Methods, data and ideas that make excellent references in solving engineering problems frequently encountered in plant operations

SIMPLIFIED WATER TREATMENT CALCULATIONS

JOSEPH T. HOGAN

SOFTENING OF WATER for purification of boiler feed and many other industrial supplies requires the use of both lime and soda ash. To calculate the quantities of these chemicals needed, an analysis of the water should be obtained showing the contents of free carbon dioxide, total alkalinity, total hardness and magnesium hardness, all expressed in parts per million of calcium carbonate ($CaCO_3$).

The charts and related instructions presented here are intended to facilitate calculations associated with determinations of lime, soda ash and the amounts of sludge produced. Beginning with water of known analysis, all answers may be read directly in pounds per thousand gallons of water treated.

Free Carbon Dioxide

Frequently, free carbon dioxide (CO_2) is omitted from the water analysis. Chart 1 permits determination of approximate carbon dioxide content from the alkalinity and pH values given in the analytical laboratory report. A straight edge aligned through values of alkalinity and pH yields free carbon dioxide on the right hand scale.

If the water analysis lists impurities in parts per million, requirements of lime and soda ash may be obtained as follows:

Cold Process Treatment

1—For the carbon dioxide reaction, the curve on Chart 2 labeled "CO_2" gives the amount of CaO necessary for removing various concentrations of CO_2 in parts per million of $CaCO_3$.

2—For the bicarbonate reaction, the curve labeled "Alkalinity" gives the amount of CaO necessary for various alkalinities expressed in parts per million of $CaCO_3$.

3—For the magnesium reaction, the curve labeled "Magnesium" gives the amount of CaO necessary for removing various concentrations of Mg expressed in parts per million of Mg. If

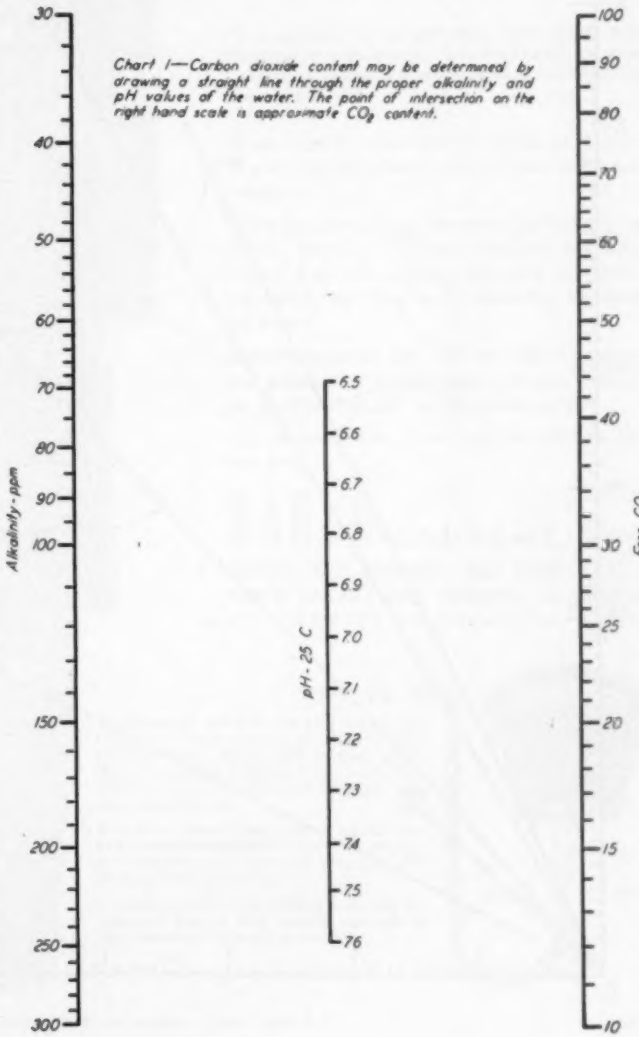


Chart 1—Carbon dioxide content may be determined by drawing a straight line through the proper alkalinity and pH values of the water. The point of intersection on the right hand scale is approximate CO_2 content.

the analysis shows magnesium as $CaCO_3$, divide by 4.11 before using the curve shown.

4—The sum of the three results as determined in Steps 1, 2 and 3 is the lime requirement of CaO in pounds per 1000 gallons of water.

Hot Process Treatment

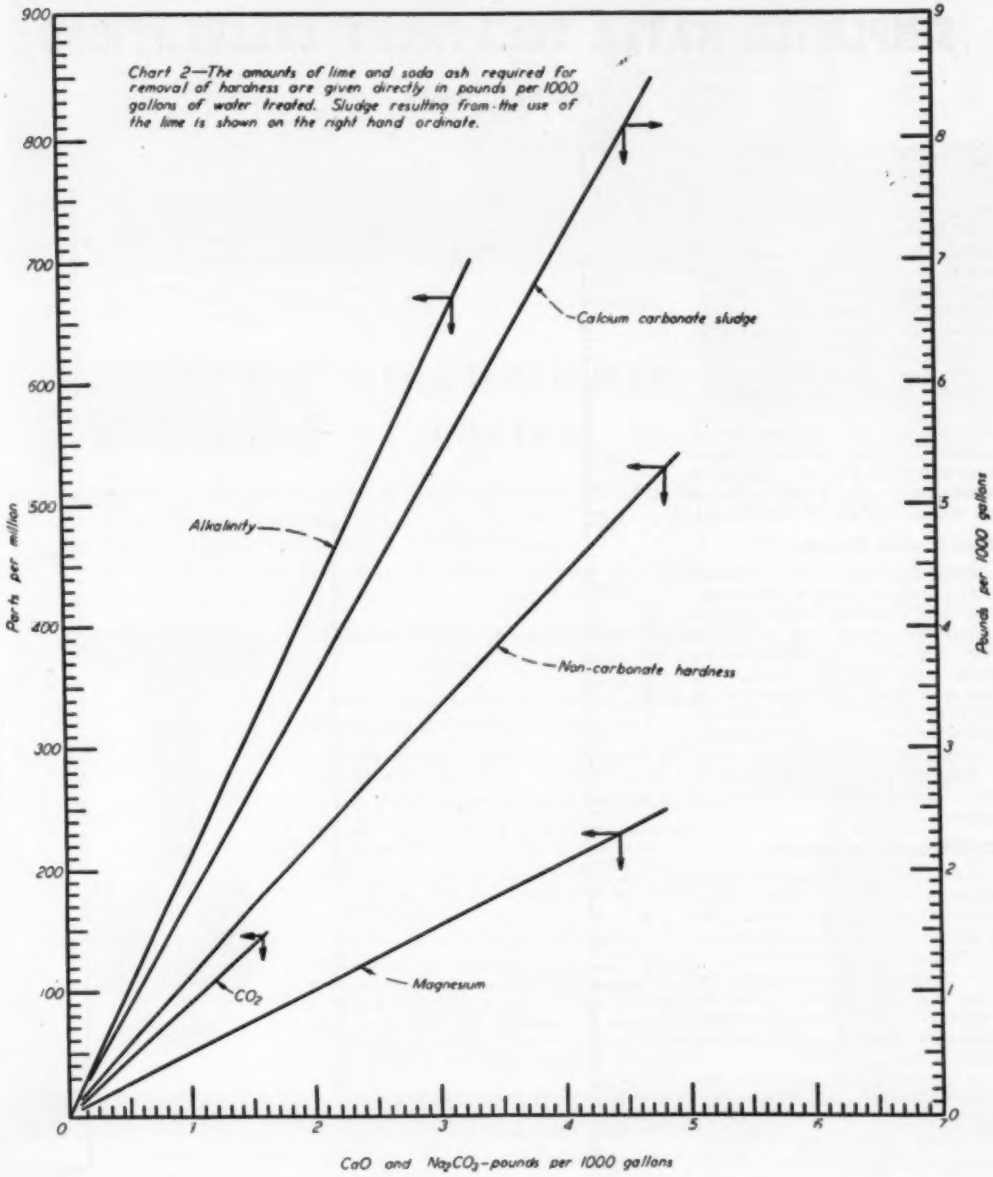
Calculations for hot process treatment are identical to those listed for cold process treatment except Step 1 is omitted since carbon dioxide is driven off during the heating process.

Soda Ash Requirement

Soda ash requirement for removal of non-carbonate hardness is given by the curve on Chart 2 labeled "Non-carbonate hardness".

Calcium Carbonate Sludge

The amount of calcium carbonate produced as sludge is given by the curve labeled "Calcium Carbonate Sludge" in Chart 2. The ordinates given on the right hand side show sludge produced per 1000 gallons of water for the amounts of lime employed during the treatment process as shown on the abscissa.



SARCO electric temperature control

ACCURACY AND SENSITIVITY BY SIMPLE ELECTRICAL MEANS

"Very successful in our operation, and I specify them on all our new equipment," says Thomas Allison, Plant Engineer of Southern Gravure Service, Louisville, Ky. ***(See photo at left)***

IN HIS CASE the operation is plating, an industry in which SARCO electric controls have found wide adoption.

There are many others: For example, dryers in the textile, tanning, food and chemical industries; dyeing and wet finishing processes in textiles; processing, distilling and evaporating in chemical plants.

SARCO's complete line includes also thermostats and solenoid or motor valves for space heating, air conditioning and refrigeration control.

Get the whole story by writing for bulletins 1025 and 1080.

SARCO COMPANY, INC.
EMPIRE STATE BUILDING, NEW YORK 1, N. Y.
SARCO CANADA LTD., TORONTO 8, ONTARIO
REPRESENTED IN PRINCIPAL CITIES

PLATING

In copper and chromium plating of rotogravure rolls, the temperature of plating solutions is held to within ½°F by Sarco Electric Indicating Temperature Controllers. Photo taken in Southern Gravure Service plant, Louisville, Ky.

CHEMICAL

Hoffman La Roche Pharmaceutical Co., Nutley, N. J.—the jacket water temperature of these stills must be held to within ½°F. For the past 9 years, Sarco LSI Indicating Temperature Controllers have been doing that job.

FOOD

Chocolate milk and soft drinks in bottles and cans are processed in Fort Wayne Sterilizers. Many users equip these Sterilizers with Sarco LSI Electric Indicating Controllers to hold the temperature to within ½°F. Hook-up sketches and case histories on request.

TEXTILE

The Backus Hosiery Conditioner processes 15 denier nylon hosiery—40 dozen per 1 hour cycle. The humidity and dry heat are controlled by two Sarco Electric Indicating Temperature Controllers. Over 200 LSI's have been factory-installed on these Conditioners by Backus Machine Works, Carlstadt, N. J.

TYPE LSI

An extremely sensitive and accurate Electric Indicating Temperature Controller for temperatures from minus 90°F to plus 650°F. Controls electric heating elements, motors, solenoid or motor valves to maintain constant temperature.

A built-in thermometer makes setting easy and provides a continuous check on temperatures maintained without the bother of continually changing charts.

A double switch type L2SI is available for alternate heating and cooling control, or step control of heating or cooling.

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Spot news

Short, "boiled-down" paragraphs on the most interesting recent events and developments in American industrial plants.

Ultrasonics Are Employed For Industrial Cleaning

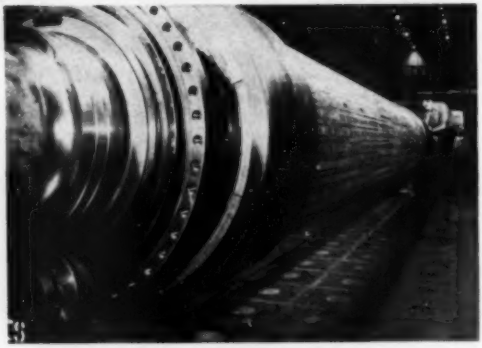
Ultrasonic equipment to produce high frequency sound waves will be used by General Electric Co. in cleaning or degreasing of small machine parts. According to the company's engineers, high-pitched sound waves directed through a liquid solvent greatly increase the solvent's effect in removing dirt, grease and metal particles from small corners and crevices.

In the less than 18 months since this method was first used in industrial cleaning, it is stated that the field has grown from laboratory research to a full fledged business.

Turbine is Designed for Highest Steam Temperature

Production of a turbine which will operate with the highest steam temperature ever used in a turbine-generator unit has been announced by G. B. Warren, general manager of the General Electric Turbine Div. The new turbine, operating at an initial temperature of 1100 F, will be used in the Kearny generating station of Public Service Electric and Gas Co., Newark, N. J. The 145,000 kw unit, first of two for this concern, will be placed in operation in the near future.

Primary objective of turbine design, according to Mr. Warren, is constantly to improve turbine-generator efficiency. Higher steam temperature is one means of achieving this objective. Previously, the highest temperature used in steam turbine generators was 1050 F. Among special design features made necessary by the high temperature is the use of stainless steel in the inner shells.



Generator rotor, one of two for Kearny generating station, is 32 ft long and weighs 100,000 lb

The Kearny machine is one of the first 3600 rpm units generating electricity at 20,000 v. Another unusual feature is that the steam generator for the turbine will employ coal, oil or gas, or a combination of all three as fuel. Steam will be used at a pressure of approximately 2350 psi.

The Cover - Industries' Servants

Today an ingenius industry has developed storage into a great economic force. Coal, eggs, vast quantities of grain, and countless other items are safely, efficiently stored under conditions scientifically designed to serve each need.

Petroleum and natural gas industries are among the largest users of storage, and the products stored —aviation gas, natural gasoline, and other allied petroleums—demand the very latest in modern designs with aluminum paint to reflect the sun's heat. One of the products, butadiene, requires refrigeration when stored.

Storage tanks pictured on the cover of this issue are located at the Cities Service refinery at Lake Charles, La. They provide part of the tankage required for housing several million barrels of crude oil and other liquids. Spherical tanks, such as these, generally hold from 7000 to 20,000 bbl at pressures from 60 to 100 psi.

Ion Exchange Resins Recover Scarce Metals from Industrial Waste Solutions

Commercial processes for the recovery of such metals as copper, tin, zinc and chromium from industrial waste solutions were described in a paper delivered at a recent meeting of the American Electroplater's Society. The paper, "Metal Recovery by Ion Exchange," was delivered by C. F. Paulson, special applications engineer for The Permutit Co. He stated that commercial applications of the processes results from development of high capacity ion exchange resins, which have long been in use for water softening.

Applications which have proved successful include recovery of zinc in waste from rayon plants, recovery of tin as sodium stannate in tin-plating alkaline baths, and recovery of copper, chromium and chromic acid used in such processes as electroplating, anodizing, copper stripping and brightening after electroplating.

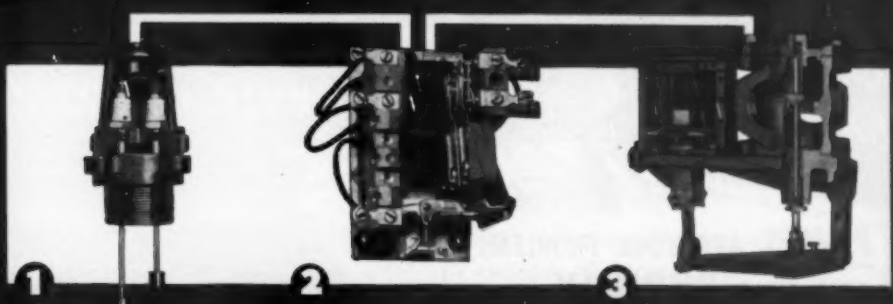
Mr. Paulson predicted that in the near future ion exchange resins will aid in the commercial recovery of precious metals such as gold and silver from ore and plating solutions. Work along these lines is now in progress.

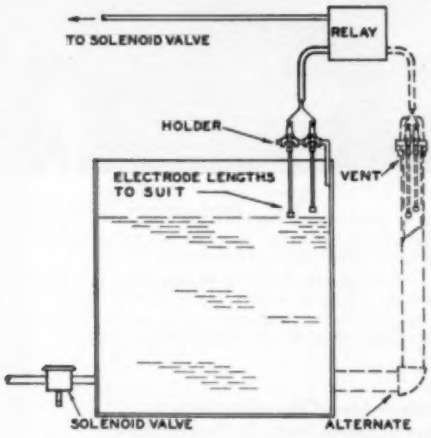
(Continued on page 114)

TANK CONTROLS

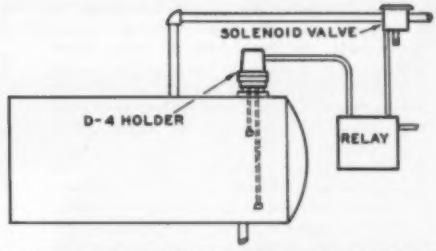
Here is a simple, dependable way to control tank levels automatically — one that reduces the task to only a few time-tested, standardized components. It is economical in cost, easy to install, flexible enough to answer practically all requirements, and dependable as the flow of electricity. Drawings below illustrate some typical applications. Chances are you can put Johnson Tank Controls to good use in your plant.

Tell us your operating requirements and we will send full details.

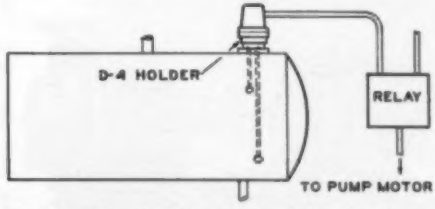




Typical installation of Johnson Tank Control in open tank. Electrode holder is suspended from bracket. Solenoid valve at bottom left opens to admit make-up when level clears long electrode, closes when level is restored to short electrode. Dotted lines show alternate mounting of electrode holder in external pipe.



Installation of Johnson Tank Control in closed tank. Solenoid valve is opened and closed by relay as liquid level falls and rises in tank. The control serves equally well to empty or fill tanks.

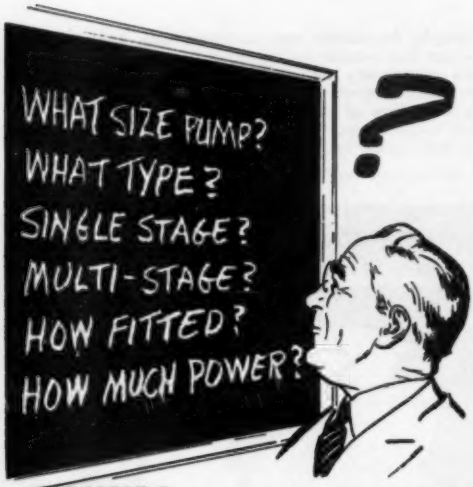


This drawing shows how the Johnson Tank Control can be used to control operation of a pump, rather than a solenoid valve. Operation of electrodes and relay is the same, starting and stopping pump motor to raise or lower the tank level.

Products of The Johnson Corporation

807 Wood St., Three Rivers, Michigan

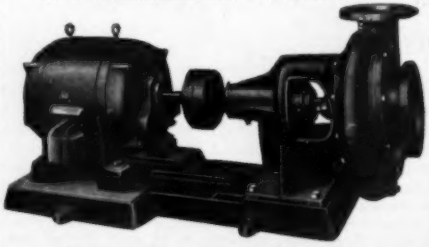
Rotary Pressure Joints • Compressed Air Separators and Aftercoolers
Direct Operated Solenoid Valves • "Instant" Steam Water Heaters



IF PUMPS ARE YOUR PROBLEM, CALL IN A WEINMAN SPECIALIST...

Selection of the right pump to handle a specific liquid handling problem, calls for skilled judgment backed by years of experience. That's why thousands of pump users have put their pump selection problems in the hands of a Weinman centrifugal pump specialist. For more than 50 years these Weinman specialists have helped pump users in every type of industry, and with every kind of liquid handling problem to get the results they wanted to put their pumping operations on a paying basis.

Basic design, precision manufacture and progressive research make Weinman centrifugal pumps first choice for low initial cost, year-round operating efficiency and virtually maintenance-free service. So, take your fluid handling problems to a specialist —your nearby Weinman representative, who KNOWS pumps. Write, wire or phone for his recommendations . . . TODAY.



Representatives in principal cities

WEINMAN Pump Mfg. Co.

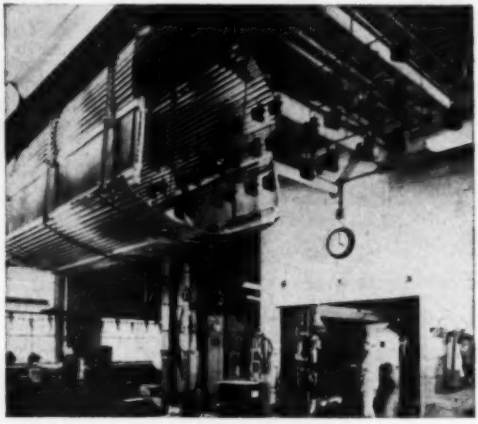
Spot news

(Continued from page 112)

Method of Mounting Oven Saves Floor Space for Instrument Manufacturer

To save valuable floor space, the Foxboro Co., Foxboro, Mass., has employed overhead mounting for a new oven used for baking paint on instrument parts. Manufactured by Edwin L. Wiegand Co., the lightweight far-infrared type unit consists of four Chromalox radiant heaters and reflective aluminum sheeting. Since this type of heat is directed and reflected into the work rather than convected around it, it has not been necessary to close the ends of the unit.

Total installed capacity of the oven is 14.4 kw, operating on 230 v. Conveyer speed is 4½ fpm. By using the far-infrared heat, all colors of paint can be baked at about the



same speed. Slower speed to accommodate light colors is therefore not required. The new unit bakes paint on 22,000 separate meter parts per 8 hr shift.

To permit easy handling of both large and small parts, a flexible conveyer system was installed. Small items are hung on frames with three tiers, while larger ones are attached directly to the main conveyer hooks.

Engineering Objectives Are Reflected in Plans for Power Show

New developments and engineering advancements will be under review at the 20th National Exposition of Power and Mechanical Engineering, to be held during the first week of December in Grand Central Palace, New York. It will be held under the auspices of the American Society of Mechanical Engineers during their annual meeting.

Advance information of displays suggest the close touch of manufacturers with scientists and new engineering project developers. One exhibitor will show centrifugal castings of special alloys, including a difficult silicon-iron bronze cage blank, cast and hot worked, for anti-friction

(Continued on page 118)

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Choose Dutton!

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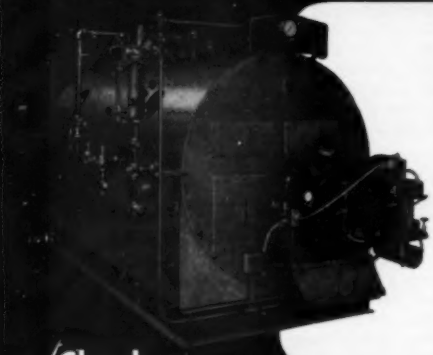

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the compact, automatic "packaged" boiler with exclusive Off-Center Firing

Compare it point-by-point — and you'll see *why* the EconoTHERM's advanced engineering *pays off* in fuel and labor saved! Off-Center Firing results in faster steaming and greater safety with guaranteed 80% efficiency. Completely automatic ... amazingly compact ... 5 or more square feet of heating surface per H.P. Gas or oil fired — to 250 H.P. Write for EconoTHERM Bulletin EC-100B.

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gives you 5-way firing convertibility... plus reliable H. R. T. design

Install it for gas, light oil, heavy oil, stoker, or hand firing — you can later convert the EconoMIST to *any* one of these firing methods. Highly adaptable, it's above all tremendously *dependable*. Of all "packaged" units, EconoMIST sets the standards for operating simplicity and low maintenance costs. Sizes from 15 to 105 H.P. Write for EconoMIST Bulletin EC-100B.

Handy Steam Cost Calculator mailed FREE on request... or ask your Dutton representative. (See Yellow Pages in Phone Book.)

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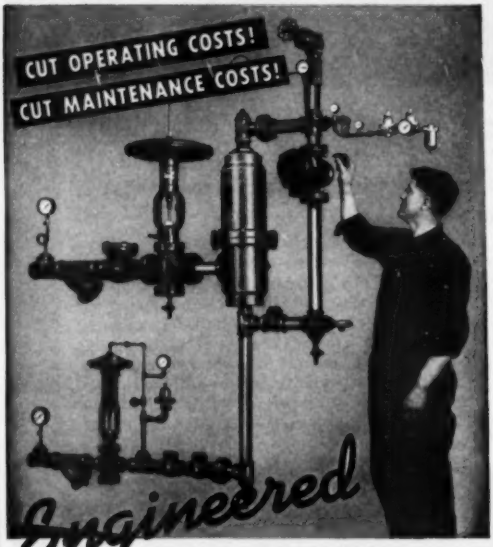

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NO STORAGE TANKS NEEDED
Compact design permits installation in corners, on walls or overhead.

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No coils. Can be cleaned in a matter of minutes — without dismantling.

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MANUFACTURED BY
PICK MANUFACTURING CO.
WEST BEND, WISCONSIN, U.S.A.

Spot news

(Continued from page 114)

bearings used in jet aircraft. A cast and forged steel manufacturer is announcing a new type cast steel valve. Another exhibit will be focused on a high pressure gate valve with breech-lock seal welded body bonnet connection.

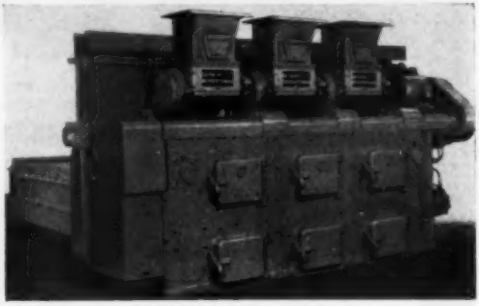
Development of a 4 in. tube by a manufacturer of dust collectors permits smaller sized equipment for plants having space limitations. Another type of dust collector, first exhibited in this country at the last Power Show, will be demonstrated in action.

Some exhibitors will feature the variety of materials in which their specialties may be obtained, while others will emphasize range of capacities available. Numerous specialties are included among the more than three hundred exhibits, such as a catalytic process for treating industrial and potable water without the use of chemicals. Another example is the exhibit of a complete system for purifying, dehydrating and degassifying insulating oil in the field or at the central station location.

New Grate Design Provides Continuous Cleaning for Small Spreader Stokers

Smokeless operation on light loads is reported to result from a new continuous cleaning grate designed for small and medium sized spreader stokers. A 40,000 lb per hr steam generator at the Detroit plant of Motor Products Corp. was recently equipped with a stoker of this type, developed by Detroit Stoker Co.

On Sept. 12, Detroit's chief smoke inspector, B. Linsky, and members of his staff witnessed a demonstration of this



unit in which it operated at both light loads and at full capacity without smoke.

Continuous cleaning is secured by a reciprocating grate, the alternate sections of which are fixed. According to the manufacturer, proper agitation of the fuel bed is provided, thus keeping it porous and at the same time avoiding any blow-holes or dead spots. Ample furnace turbulence is provided by a combination overfire air and cinder return system. The new grate design is said to offer continuous cleaning benefits for spreader stokers from approximately 100 rated boiler hp to 75,000 lb per hr.

— End

protection

Let's be realistic: While approval tests require short circuit interruption at 5000 amperes, short circuits of that size are virtually impossible in most circuits. Wiring and circuit components . . . just what you are protecting . . . would be damaged by below 5000 amperes.

Common short circuits run 200 to 300 amperes at most. That is why most equipment manufacturers specify HEINEMANN Circuit Breakers. With HEINEMANN, the instantaneous trip point is *always* 10 times the rating . . . high enough to allow harmless, temporary overloads; yet sufficiently low to provide absolute protection.

This performance in the *critical protection zone* is far in excess of mere approval tests . . . and it is a necessity for adequate protection of your equipment and circuits.

don't use heat . . . *USE POWER*

INSTANTANEOUS TRIP POINT of Heinemann Circuit Breakers is always 10 times rated capacity. It never changes.

TIME DELAY ZONE provided by change in magnetic flux caused by moveable core. Delay time is inversely proportional to overload.

RATED LOAD is always carried. Heinemann Circuit Breakers are fully magnetic . . . employ no thermal elements, thus never need de-rating. They are unaffected by heat or cold.

New Literature tells the facts

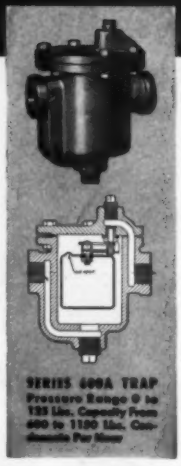
Send for your copy of the new, informative bulletin entitled, "What You Should Know about Circuit Breakers". HEINEMAN ELECTRIC COMPANY, 140 Plum Street, Trenton 2, N. J.

HEINEMANN *Circuit breakers*

HEINEMANN Circuit Breakers . . . One, two and three pole . . . 10 milliamps to 100 amperes

NOTED FOR *Efficiency...*

This simple mechanism is *Easy* to install... *Easy* to service



HOFFMAN Bucket Traps operate intermittently and are particularly applicable to draining condensate and air from steam lines or equipment where large quantities of air and condensate must be discharged. They are easily inspected, cleaned and serviced by merely removing the cover assembly.

Straight-through pipe connections permit close-to-floor installation.

All working parts are connected to the bonnet and are removable with it for service without breaking pipe connections.

These are features of design appreciated by the maintenance man in saving man-hours when manpower is costly and scarce.

Hoffman Bucket Traps are adjustable to a wide choice of pressures, simply by changing valve seats. Send today for full information, no obligation.

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Reviews of recent books . .

Write to the publisher for books in which you are interested

Electric Motors

"Fractional H.P. Electric Motors," by F. G. Spreadbury, M. Inst. BE, MAIEE, Northampton Polytechnic, London. Distributed by Pitman Publishing Corp., 2 West 45th St., New York 19, N. Y. 340 pages, illustrated with photographs, sketches and curves. Price $7.50.

Intended to meet most interests in fractional hp motors with respect to principles, performance, control and design, the book emphasizes characteristics and their effects in the smaller sizes, and thereby includes considerable information which is not available in literature on the integral and larger sizes. The principles of most fractional hp motors are treated, and a basis for design is given. Also included are chapters on speed control and determination of performance characteristics, along with methods and equipment for making measurements. It should be of interest to those who are concerned with the application, basic design and control of small motors.

Meetings and exhibitions . . .

OCTOBER

Third Annual National Noise Abatement Symposium will be held at Technology Center, Chicago, Oct. 10. The Acoustical Materials Association is a co-sponsor of the event.

American Welding Society holds its annual meeting at the Bellevue-Stratford Hotel, Philadelphia, Oct. 19-24.

National Metal Show will take place in the Philadelphia Auditorium, Philadelphia, Oct. 20-24.

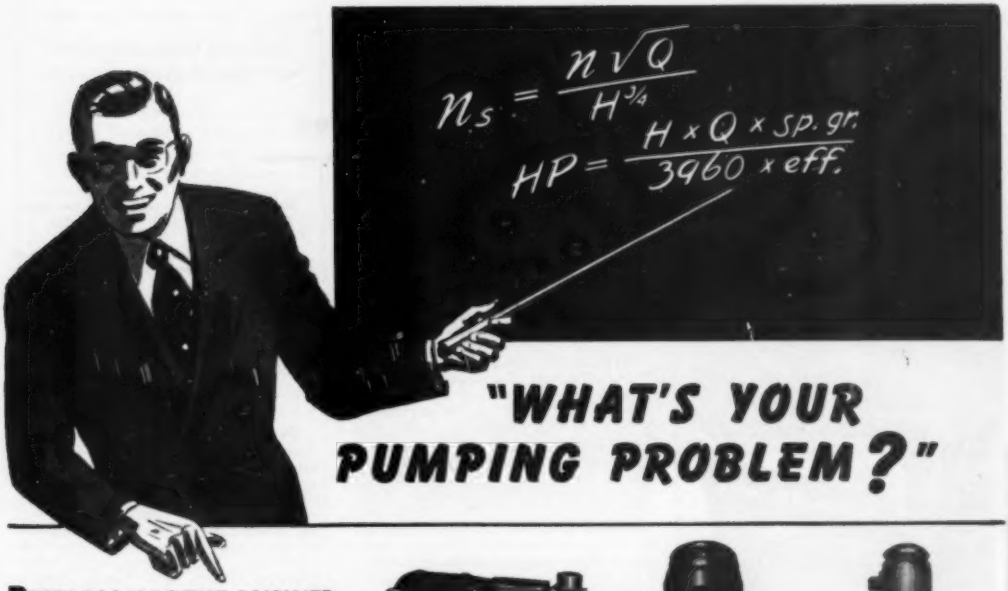
Fourth Biennial Materials Handling Conference, sponsored by Westinghouse Electric Corp., will be held in the Hotel Statler, Buffalo, Oct. 28-29.

DECEMBER

Twentieth National Exposition of Power and Mechanical Engineering, under the auspices of the American Society of Mechanical Engineers, will be held in Grand Central Palace, New York, Dec. 1-6.

Society of Experimental Stress Analysis will hold its annual meeting and exhibition at the Hotel McAlpin, New York, Dec. 3-5.

—End



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PEERLESS HAS THE *ANSWER*

Many of the problems of transferring liquids which are troublesome to you today have probably already been successfully studied and solved for others by our engineering department.

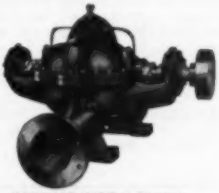
Problems arising from countless combinations of conditions of capacity, head, temperature, pressure, specific gravity, viscosity, volatility, chemical analysis, solids concentration, NPSH and other variables have been resolved by our hydraulic engineers. From thousands of case histories we can counsel with you on everything from pump cavitation caused by incorrect sump construction, to the design limits of impeller diameters as effected by peripheral speeds.

Why not take advantage of a backlog of 30 years of practical pumping experience to solve your liquid transfer problems?

Hand us your pumping problem. We believe we can give you a successful Peerless answer to it from the scores of types and hundreds of models of horizontal and vertical Peerless pumps.

PEERLESS FLUIDYNE PUMPS

A line of face mount and flexible-coupled, electrically driven pumps for almost universal water pumping application. Capacity range: to 5500 gpm. Completely described in Bulletin No. B-2300.



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The standard of the industry for high quality, split-case horizontal pumps. Capacity range: up to 70,000 gpm. Completely described in Bulletin No. B-1300.

PEERLESS CLOSE-COUPLED VERTICAL TURBINE PUMPS

Widely and successfully used in cooling tower service and pumping from surface water sources. Up to 2500 hp. Completely described in Bulletin No. B-189.

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The giants in the world of moving water. Both propeller and mixed-flow types available. Completely described in Bulletin No. B-148.

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They keep you out of trouble . . . and Save You Money

You get a lot of plus values . . . and avoid a lot of failure headaches and possible accidents . . . by using Jerguson Flat Glass Gages for every liquid level indicating use.

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Write us about your problems or requirements.

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News
of men and companies

SOCIETIES

American Society of Mechanical Engineers—F. S. Mallette, assistant director of research in charge of air-pollution control activities, American Steel and Wire Div., United States Steel Co., is named full-time exec. secy. of the committee on air-pollution controls.

Welding Research Council—T. H. Wickenden, v-p in charge of development and research of The International Nickel Co., Inc., is elected a member of the Welding Research Council of the Engineering Foundation for a three-year term beginning October 1.

ANNOUNCEMENTS

General Controls Co.—Luncheon attended by civic officials, officers of business groups, and executives of business firms in the Chicago area highlighted opening of new plant at Skokie, Illinois.

General Electric Co.—A six-man marketing team of the large motor and generator dept is making a tour of the company's U. S. sales districts to discuss mutual problems and to inform customers and sales engineers of the latest equipment developments. The tour, which is headed by J. F. Eckel, genl mgr of the dept, will continue through October.

Minneapolis-Honeywell Regulator Co.—Industrial Div. announces that ball-point pens with red ink which provide greater contrast to blue-lined charts are now available for use with its instruments.

National Electric Products Corp.—Selects "Nepconol" as the new trade name for its expanded line of Thermoplastic insulated wires and cables, including building wires.

Skil Corporation—Is the new name of Skilsaw, Inc., effective October 1.

Wright Chemical Corp.—Enters into a sales agreement with the Refinite Sales Co. for the sale of external water treating equipment. The new agreement enables Wright to offer demineralizers, dealkalizers, deaerators and other equipment for mechanical conditioning of water on a nation-wide basis.

HONORS

Dr. A. J. Buchi, of Winterthur, Switzerland, an authority on diesel engines, will receive the George R. Henderson Medal of The Franklin Institute. The citation accompanying the medal will read as follows: "In view of his contributions in augmenting the capacity and performance of the four-cycle diesel engine through his turbocharging system, in all classes of service, but particularly in the railway field."

E. L. Hall, director of the testing laboratories of the American Gas Association, Inc., will be awarded a Walton Clark Medal "in consideration of his many contributions to the gas industry including the invention of a new and more efficient process for the production of high heating value gas as a substitute for natural gas." Formal presentation of the awards will be made at Medal Day ceremonies in Franklin Hall on October 15.

ANNIVERSARIES

Black, Sivalls & Bryson, Inc.—Recently completed its sixtieth year of continuous operation. A $2 million expansion of plant facilities has been virtually completed. The program includes major expansion of the Kansas City and Oklahoma City plants.

Being loaded for shipment is the first I-T-E mechanical rectifier to be used by British industry. With power converted from 11,000 v, 3 phase, 50 c, the rectifier will supply 10,000 amp at 250 v d-c to an electrochemical cell line at Imperial Chemical Industries, Ltd.

INDUSTRIAL FIRMS TO STUDY NUCLEAR POWER PRODUCTION

The Atomic Energy Commission has accepted a proposal by Pioneer Service and Engineering Co. and Foster Wheeler Corp. to conduct, during the next 12 months, a survey to determine the feasibility of power-producing reactors.

Listed among the objectives of the studies are: determination of the engineering feasibility of design, construction and operation of a reactor by private enterprise; examination of the economic and technical aspects of building such a reactor; measure of research and development work needed before such a project could be undertaken; and recommendation to the AEC as to what should be the specific role of industry in carrying out the project.

All costs on the first phases of these studies will be borne by the companies, except cost of time and effort of the AEC and its contractors. The AEC will decide on the distribution of reports and all inventions and discoveries made in the course of the work.

SALES OFFICES

The Babcock & Wilcox Co.—The Cleveland district sales office of the Tubular Products Div. moved into larger facilities located on the fourteenth floor of the National City Bank Building, 629 Euclid Ave.

Leeds & Northrup Co.—The Philadelphia district sales office moved from 4901 Stenton Avenue to new and larger quarters at 444 North 16th Street.

Raybestos-Manhattan, Inc., Manhattan Rubber Div.—Announces opening of its new Denver, Colo. warehouse at 4500 York St. E. T. Fair, Jr., sales repr for the territory, is in charge.

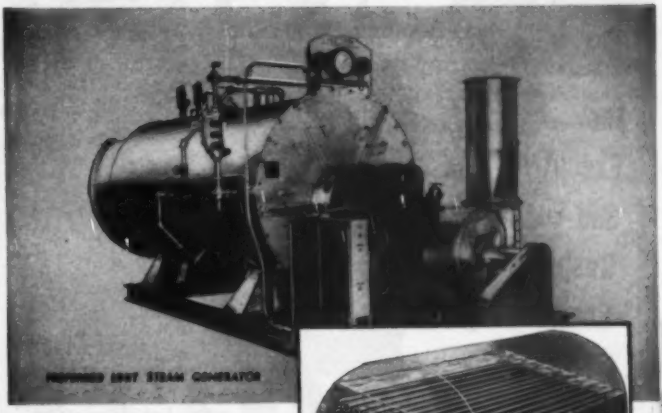
Syntron Company — The Syntron Newark Sales Co., representing and selling the entire line of vibratory material handling equipment, selenium rectifiers, etc., opened a new headquarters in Hasbrouck Heights at 140 Route 17 and Henry Street. The rental and sale of electric hammers, gas hammer paving breakers and rock drills, portable electric saws and concrete vibrators will be handled at this same address by the Syntron Power Tool Co.

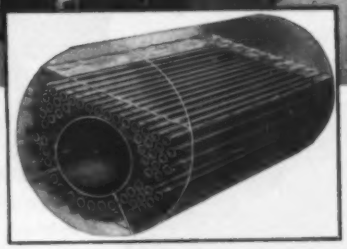
EXPANSIONS

Ceco Steel Products Corp.—Purchased an 18-acre tract in Broadview, Ill. for construction of an additional plant. Plans call for 50,000 sq ft of floor area which will be used for fabricating reinforcing steel and for warehousing. In addition new fabricating plants are to be erected in Omaha, Neb. (23,600 sq ft) and Kansas City, Mo. (14,200 sq ft). Contracts have been let and construction is about to start.

(Continued on page 122)

there IS a difference...*





*One of the many Preferred's 25-year features that insures dependable performance. Five square feet of heating surface per boiler horsepower.

PREFERRED *never compromises* QUALITY!

Another one of the many outstanding "quality features" of the Preferred Unit Steam Generator is the basic design of five square feet of heating surface per boiler horsepower.

Hundreds of installations, backed by many years of experience and records, have consistently proved — many times over — that this ratio affords maximum practical thermal efficiency and maximum life expectancy . . . *25 years of dependable, low maintenance-free service at a minimum efficiency of 80%.*

With Preferred Unit Steam Generators, five square feet per boiler horsepower and lower BTU heat release offer, in turn, a lower temperature gradient preventing steam blanketing of wet surfaces, a cause of pressure vessel loss. An increase in temperature gradient through insufficient surface, higher BTU heat releases and consequent steam blanketing rapidly increases the rate of precipitation, vitally affecting life expectancy, maintenance and operating costs.

— This feature . . . and many other "quality features" are described in detail in Bulletin 2000.

PREFERRED UTILITIES MFG. CORP.
1860 BROADWAY • NEW YORK 23, N. Y. G10

4 "Grates"

For Executives and Engineers Responsible for Engineered Plant Services

KLEMP Metal Gratings

- *Protect against floor wastes*
- *Reinforce all concrete surfaces*
- *Insure fireproof, non-slip footing for men and traffic*
- *Insure efficiency with safety*
- *Insure protection, plus comfort through complete ventilation*

The Klemp Metal Grating Corporation has been serving the needs of those men responsible for the safety of plant employees and the maintenance of all types of flooring for almost half a century. This includes stairways, stair treads, runways, catwalks and tower stairs in industries where there are flooring problems, such as chemical and gas plants, power stations, oil refineries, or where there are turbine rooms and pump rooms. During this time, Klemp has produced and patented several specialized gratings including Hexteel and Floorsteel.

Klemp's engineers have exclusively specialized in the fabrication of gratings such as Hexteel Surface Armor and Floorsteel Flexible Floor Armor for reinforcement of all surfaces where concrete or mastic are applied.

Klemp's diamond riveted and welded gratings are ideal for foot and plant material traffic wherever rugged strength is needed in structural footwalks, stair treads and open steel flooring.

We solicit the opportunity to let Klemp's engineers help solve your most difficult grating problems. Send in your blueprints for quotations today. All types of Klemp Gratings are available for immediate shipment.

KLEMP METAL GRATING CORPORATION

News

of men and companies

(Continued from page 121)

The Babcock & Wilcox Co.—Purchased facilities of a former shipyard from the Brunswick Port Authority at Brunswick, Ga., and plan to convert it into a plant to build boilers and related equipment.

Barco Manufacturing Co.—New plant being constructed at 500-530 N. Hough St., Barrington, Ill., for occupancy early in 1953 will provide 103,000 sq ft of floor space for offices, manufacturing, and other facilities.

Wagner Electric Corp.—Purchased from Fulton Iron Works Co. a portion of their property, consisting of 3 acres of land with four buildings, adjoining the Wagner main plant. The newly acquired buildings will be completely renovated and modernized. Also plans expansion of present facilities for the manufacture of large power transformers. It is estimated that completion of the $1 million program will require at least a year.

NEW REPRESENTATIVES

Copes-Vulcan Div., Continental Foundry & Machine Co.—Appoints Carl Grimes & Co., 1000 Ninth St., Des Moines, as representatives in the state of Iowa.

Elgin Softener Corp.—Announces appointment of S. C. May as sales representative for Georgia, Florida and lower South Carolina, with hqtrs at 585 Sherwood Road, N. E. Atlanta.

Superior Combustion Industries, Inc.—Johnson-Heyck Inc., 430 West Building, Houston, is named sales representatives to handle the sales of Superior Heat Exchangers in Texas.

C. D. Johnson **T. R. Heyck**

Gustin-Bacon Mfg. Co.—Announces the distributorship of the Southern States Iron Roofing Co. for Ultralite glass fiber insulation is extended to North and South Carolina. E. W. Beall, Jr. is mgr of the Columbia office and H. Nash mgr of the Raleigh office.

Geo. P. Reintjes Company—New representative in Birmingham and Atlanta areas is R. D. Osgood, associated with H. G. Mouat, 544 American Life Building, Birmingham.

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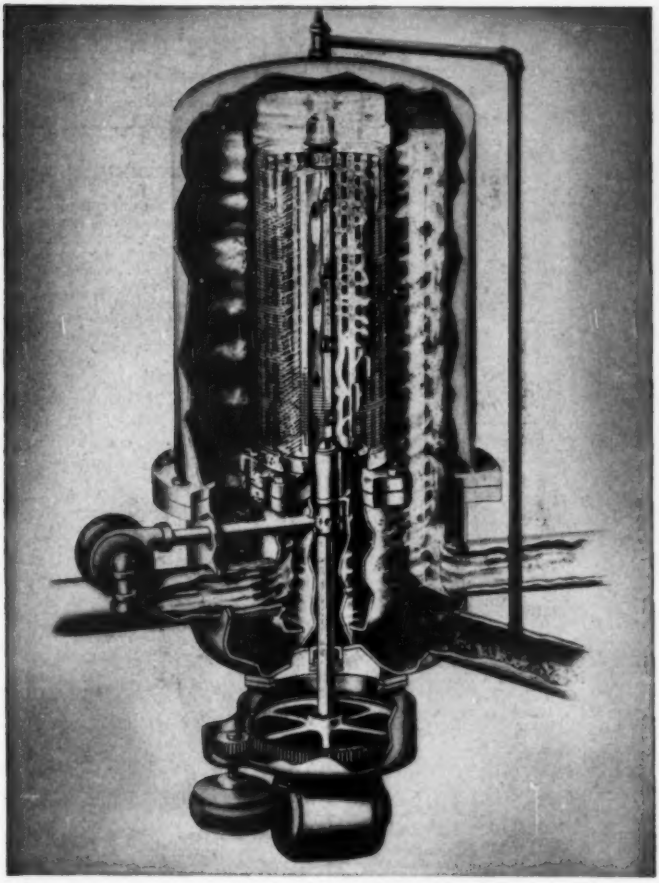


How many times do you re-use your water?

Cut water *waste* and water *bills*. Make used process water fit for re-use by running it through a Cuno FLO-KLEAN strainer. Also—a low-cost way to clean raw river or lake water for industrial use.

CUNO

Fluid Conditioning

Removes More Sizes of Solids from More Kinds of Fluids

Strain fuels, lubricants, process fluids, etc.—AUTO-KLEAN
Filter fuels, lubricants, process fluids, etc.—MICRO-KLEAN
Clean raw water, recirculating water, etc.—FLO-KLEAN

Works without Attention to Furnish Clean Water —Cheap

This is the way many industrial plants solved the problem of high water bills and low water supplies.

They use Cuno FLO-KLEAN Strainers to remove trash from raw water . . . or to reclaim used process water.

Some users have saved enough to pay for their FLO-KLEANS in a few months!

The FLO-KLEAN is a large-capacity (up to 20,000 gpm), corrosion- and abrasion-resistant strainer which positively removes all solids larger than specified.*

Continuously Self-Cleaning

Operation is continuous—with never a stop for cleaning the FLO-KLEAN. This eliminates the need for a duplex installation.

Self-cleaning is accomplished by an automatic backwash system which makes a further saving of water by recycling the backwash.

So—with continuous cleaning of the cartridge and automatic top and bottom blow-down, there's nothing to worry about. FLO-KLEAN can be installed in some remote place and forgotten.

*May be specified from .030 in. down to .0035 in.

Cuno Engineering Corporation
Dept. 142F, South Vine Street, Meriden, Conn.

Please send information on Cuno FLO-KLEAN for straining raw water..... reclaiming process water....

Name..... Title.....

Company.....

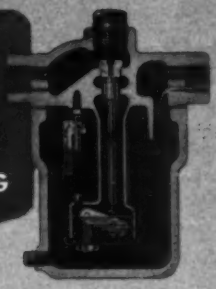
Address.....

City.....Zone....State.....

Please attach to business letterhead

RELIABILTY

DESIGNS THAT REPRESENT 50 YEARS TRAP BUILDING EXPERIENCE



"airxpel"

STEAM TRAPS

Remove Both Air and Condensate

"CUB" TYPE
½" to 1½"
to 250 PSIG

"MASTER" TYPE
½" to 2"
to 300 PSIG

"Y" STRAINERS
2" to 8" (flanged)
½" to 3" (threaded)

FORGED STEEL
½" to 1¼"
to 600 PSIG

This equipment offers design advantages that represent long experience in building steam saving devices for industry.

Orifices of Wright-Austin traps can be interchanged without disassembling the trap. Connections are the straight-through type. Both of these features contribute to speed and ease of installation.

Wright-Austin traps are available for lines ½" to 3", for pressures up to 600 P.S.I.G. and with capacities up to 65,025 pounds of water per hour.

For complete information on traps and other accessories that you can stock to advantage and depend on for efficiency that means low cost, write, today, for:

Trap Catalog #600
Separator Catalog #500
Boiler Trim Catalog #700

WA Standard STEAM USERS SINCE '94

WRIGHT-AUSTIN
COMPANY
3245 WIGHT STREET • DETROIT 7, MICH.

News

of men and companies

(Continued from page 122)

APPOINTMENTS

Allis-Chalmers Manufacturing Co.—W. R. Call is named service supervisor for the mid-Atlantic region of the general machinery div with hqtrs in Philadelphia. New asst chief engineer at the Pittsburgh works is W. M. Terry, Jr. J. F. Potochnik is assigned to the atomic power section as asst engineer. Ten electrical engineers have been named to posts in the power dept. They are: G. F. Eckenstaler, Jr., assigned to the electronics section; D. Williams and P. I. Nippes, motor and generator section; J. L. Grim, J. A. Keymar and S. McDowell, substation section; N. Kreckon, switchgear section; and F. Ladd, S. R. Lindgren and R. E. Horn, transformer section.

Blaw-Knox Co.—Appoints G. L. Dirks to the position of genl mgr of the Blaw-Knox Div. He succeeds D. V. Sherlock, who returned from retirement to serve temporarily as acting genl mgr of this div.

G. L. Dirks W. N. Shepard

Boston Woven Hose and Rubber Co.—Promotion of W. N. Shepard to director of sales is announced.

Atlas Chain and Manufacturing Co.—F. R. Pinter is promoted to mgr of the foreign sales office at 250 W. 57th Street, New York.

BullDog Electric Products Co.—J. B. Cataldo now directs activities of the electrical laboratory as director of research and development. New field representative A. S. Larsen is assigned to the New York office, and K. L. Kelley covers the Huntington, W. Va. territory.

Dearborn Chemical Co.—Adds T. B. Manheim to its sales staff. He takes over the Philadelphia and Delaware territory, with his hqtrs in Philadelphia.

The Cooper-Bessemer Corp.—Assigns L. P. Head as sales engineer to the regional office at St. Louis. R. E. Hensley reports to the Tulsa office where he will devote his efforts to engineering the installation of diesel engines, gas and air compressors for pipe lines, refineries and chemical plants in the Oklahoma area.

(Continued on page 126)

*QUARTER-MILE ROADBED...sun-baked, ice-swept...*YET STILL ON THE MOVE AFTER 14 YEARS OF COAL HAULING SERVICE!!!

Photographs may not lie; but, here's one that falls far short of telling the whole truth about the remarkable performance records chalked up by this Republic Rubber's Coal Handling Conveyor Belt.

But, then it's quite a story! You can see for yourself there's lots of sky overhead and that means sun . . . constant, unrelenting sun beating down on the conveyor belt surfaces, until seasonal changes bring about onslaughts of rain, snow and sleet.

The load, of course, is coal . . . an abrasive, mine run coal that's dropped through chutes and carried by the belt to stockpiles located throughout the dock area.

With these facts in mind and knowing that when the ship moves out, there's nothing to protect the belt against spraying lake water, consider this:

The belt is now fourteen years old and still going strong!!!

Purposefully, we've left the photo unretouched to show you just what a 14-year old Republic Rubber Conveyor Belt really looks like . . . to show you just how well a Republic Conveyor Belt stands against the ravages of time, hard labor and all the elements can throw at it. Incidentally, the dark spots you see on the belt's surface aren't worn places at all. That's water . . . water that makes ordinary conveyor belts mildew and prematurely fail, but holds few terrors for Republic Conveyor Belting because they're "mildew-proofed"!

It's to your advantage to learn why Republic Conveyor Belts like this can year in, year out, many times outperform and outlast other brands of belting.

Despite abrasion, impact, flexing, weathering or contact with heat, oil and chemicals, Republic Conveyor Belts continue to be your best insurance against breakdowns, short life and high handling costs.

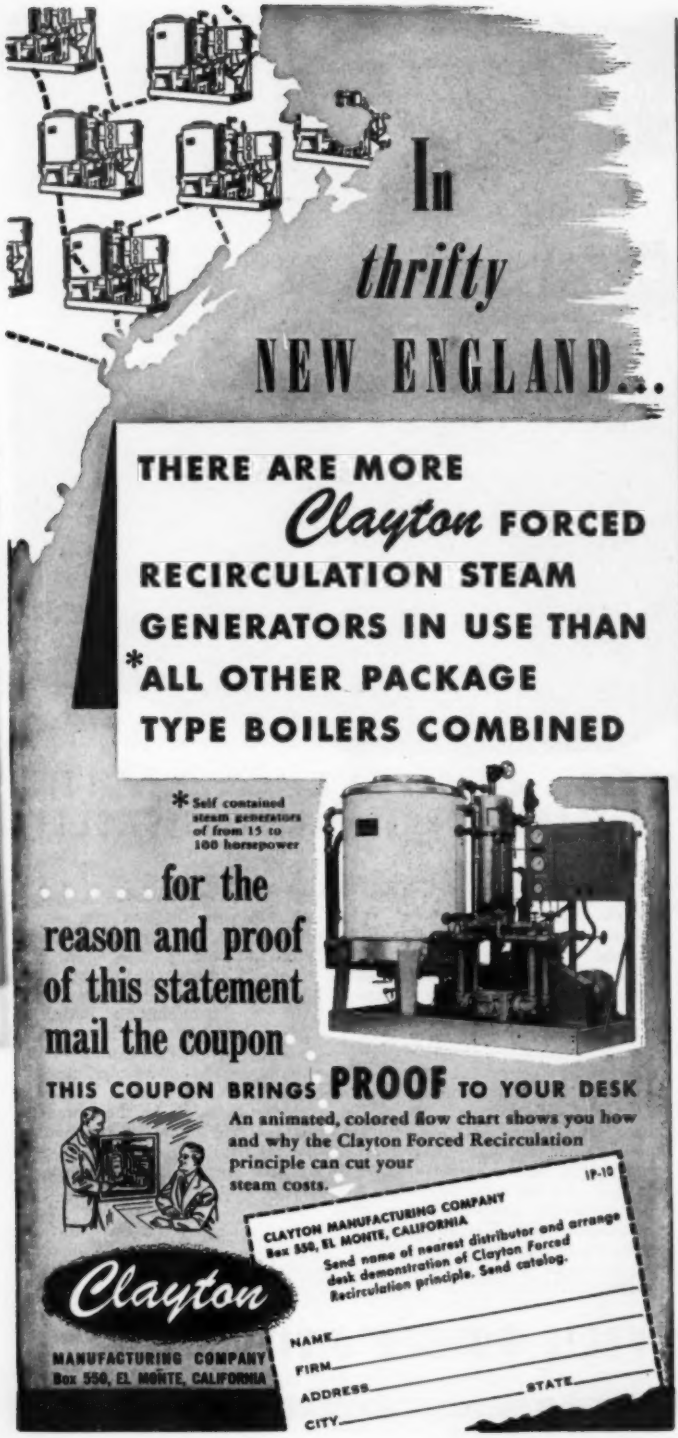
Write us today for the name of your local Republic Rubber Distributor who can offer expert advice and fast service on all industrial Rubber Products.

Remember, whether it's hose, belting, packing or any one of hundreds of different molded and extruded specialties . . . **if it's built of rubber, Republic builds it better!**

REPUBLIC RUBBER DIVISION

LEE RUBBER & TIRE CORPORATION, YOUNGSTOWN 1, OHIO

INDUSTRIAL RUBBER PRODUCTS


In
thrifty
NEW ENGLAND...
THERE ARE MORE
Clayton FORCED
RECIRCULATION STEAM
GENERATORS IN USE THAN
*ALL OTHER PACKAGE
TYPE BOILERS COMBINED
* Self contained steam generators of from 15 to 100 horsepower
for the reason and proof of this statement mail the coupon
THIS COUPON BRINGS PROOF TO YOUR DESK
An animated, colored flow chart shows you how and why the Clayton Forced Recirculation principle can cut your steam costs.
IP-10
CLAYTON MANUFACTURING COMPANY
Box 550, EL MONTE, CALIFORNIA
Send name of nearest distributor and arrange desk demonstration of Clayton Forced Recirculation principle. Send catalog.
NAME
FIRM
ADDRESS
STATE
CITY
Clayton
MANUFACTURING COMPANY
Box 550, EL MONTE, CALIFORNIA

News

of men and companies

(Continued from page 124)

Hapman-Dutton Co.—Announcement is made of two top appointments in the sales and service departments of Dutton Boilers Div. S. J. Pachyn, formerly asst general sales mgr of Combustion Control Corp., is named general sales manager. H. Williams, recently in the field service dept at Dutton, is named service mgr and asst sales mgr.

S. J. Pachyn **O. A. Schiller**

Dollinger Corp.—G. A. Schiller, formerly with the Dustex Corp., is named asst sales mgr.

Fairbanks, Morse & Co.—W. E. Watson is promoted to assistant to the mgr of manufacturing with hqtrs in Chicago. P. R. Flood is transferred to Pomona, California, where he is appointed genl mgr of the Pomona Pump Works succeeding C. L. Barrett who becomes a consultant to the pump div. L. H. Kessler is named chief hydraulic engineer at the Beloit Works. He succeeds R. C. Glazebrook who has been on special assignment to the genl mgr with duties relating to the new plant now under construction in Kansas City, Mo. R. B. Craig is appointed asst to the president, working on special assignment. S. L. Fry is named asst mgr of the pump sales div with hqtrs in Chicago.

The B. F. Goodrich Co.—R. T. Bules is named mgr, V-belt sales, industrial products sales dept. He succeeds G. J. Fischer who resigned.

The Jeffrey Manufacturing Co.—Announces the following changes in the home office personnel: C. W. Hawley, formerly sales mgr of the products engineering div, is named mgr of original equipment sales, merchandise div. L. L. Grooms replaces Hawley.

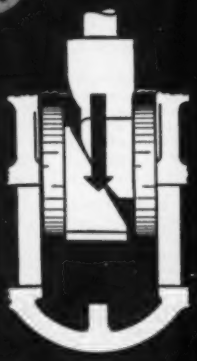
Recent changes in district office personnel include: adding C. Verhine, of the Columbus office, to the Milwaukee sales staff; transferring J. A. Lowry to the home office from New York; and assigning E. Longnecker to Detroit from the Columbus district office, replacing R. Monsarrat who is named mgr of the Philadelphia district office.

New York Belting & Packing Co.—J. C. Durbin, Jr. is named a factory sales representative in Washington, Oregon and Idaho. He makes his hqtrs in Portland, Ore.

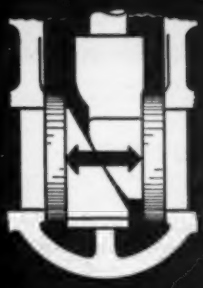
(Continued on page 128)

Look how you gain LONGER, TROUBLE-FREE VALVE LIFE

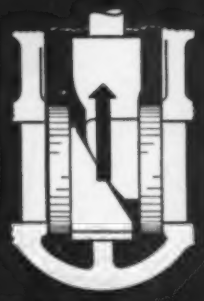
with Darling revolving disc gate valves*



DESCENDING. Fully revolving discs, independently hung, change seating position at each closing, assuring uniform wear distribution for prolonged service. Plain "no pocket" discs are interchangeable for *extra* life!



CLOSED. Faces of upper wedge are radiused and faces of both wedges are transversely beveled for equalized wedging pressure and *tight closing despite valve body distortion.*



RISING. Wedging pressure on both discs is released before discs start to rise. Complete absence of wedging pressure during travel of discs assures easy operation, tight closing and greatly prolonged valve life!

***DARLING REVOLVING DISC GATE VALVES FOR EVERY NEED . . .**

These unique valves are available in iron, bronze, steel, special corrosion-resistant alloys and combinations, and in a broad range of sizes, for all kinds of normal and unusual services in pressures up to 1500 pounds. Before you buy gate valves of *any* type, find out what you stand to gain by using the proper Darling valves. Simply outline your service requirements and ask for a free, descriptive bulletin.

DARLING VALVE & MANUFACTURING CO.

Williamsport 9, Pa.

Manufactured in Canada by Sandilands Valve Manufacturing Co., Ltd., Galt 19, Ontario.

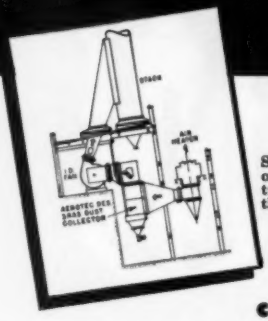
DARLING VALVES

FOR PLUS VALUES, JOB-PROVED AGAIN AND AGAIN

another power plant application of the

AEROTEC DUST COLLECTOR

promoting better community relations



Riverton Station
Northern Virginia Power Company

Sectional drawing shows location of AEROTEC Dust Collector between air heater and I.D. fan at this Riverton Station.

Promote your

community relations

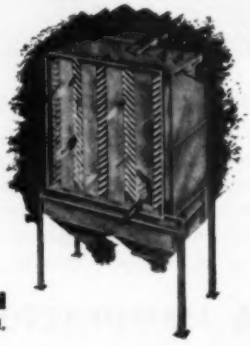
the highly efficient Aerotec way

A clean stack has proven time and again to pay valuable dividends in community good will. To gain this advantage, plus plant erection and maintenance economies, public utilities are specifying the Aerotec Design 3 RAS Dust Collector. This unit develops a higher centrifugal force through the use of multiple, small-diameter tubes, resulting in exceptionally high efficiencies on ultra-fine dusts.

Flexible and space-saving

The tubes are permanent mold aluminum and closely nested to provide lighter weight and more capacity per square foot of plan area than any collector of comparable efficiency. They are set at a 45° angle on vertical tube sheets, factory-assembled into lightweight "building block" sections that reduce installation time and permit the Aerotec Design 3 RAS to be easily tailored to fit available space.

Our field engineers specialize in solving flyash collection problems and welcome the opportunity to assist you at any time. Call or write. No obligation.



Project Engineers

THE THERMIX CORPORATION
GREENWICH, CONN.
(Offices in 38 Principal Cities)

Canadian Affiliates: T. C. CHOWN, LTD.
Montreal 25, Quebec — Toronto 3, Ontario

THE AEROTEC CORPORATION
GREENWICH, CONN.

News

of men and companies

(Continued from page 126)

Johns-Manville Corp.—Appoints J. B. Jobe, asst district mgr of the Industrial Products Div. at Los Angeles.

Nordberg Mfg. Co.—Election of Admiral A. G. Noble, USN, (Retired), as executive v-p; a member of the executive committee and a member of the board of directors is announced.

Sterling Electric Motors, Inc.—Names H. F. Ziegler, Jr., Kansas City district mgr.

Taylor Instrument Companies—R. C. Brostedt is the new manager of sales to the power industry. He will also head up sales to the brewing, metal and sugar industries.

Westinghouse Electric Corporation—W. J. Henry is named mgr of the Homewood manufacturing and repair plant in Pittsburgh. He succeeds J. H. Thomas who recently was appointed mgr of manufacturing at the East Springfield, Mass. plant.

S & C Electric Co.—J. R. Conrad, formerly v-p and treasurer is named president, succeeding his father, N. J. Conrad, who has been elected chairman of the board.

J. R. Conrad — G. H. Welch

I-T-E Circuit Breaker Co.—G. H. Welch is named asst to mgr, Switchgear Div. He will be responsible for all switchboard sales, engineering, and manufacture, directly assisting G. E. Heberlein, div mgr.

Whitney Chain Co.—Has appointed A. J. Swisler a regional mgr for the West Coast and G. A. Banton dist mgr of the So. Cal. and Ariz. territory.

L. J. Wing Mfg. Co.—New ad and publicity mgr is D. A. Burns.

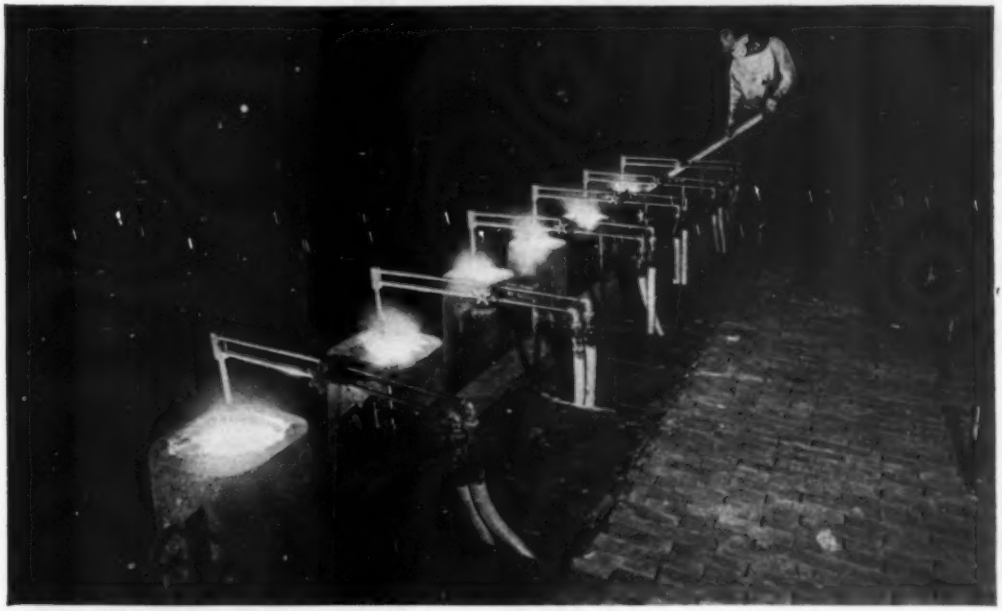
OBITUARIES

H. J. Fraser, v-p in general charge of all plant operations in the United States of The International Nickel Company, Inc., died August 22 after a brief illness, in his 55th year.

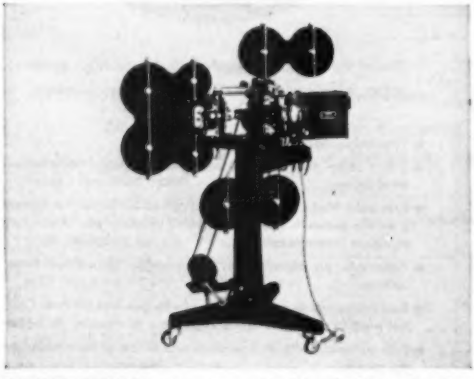
W. R. Ray, inventor, industrialist and engineer, and chairman of the board of directors of the General Controls Co., died recently.

—End

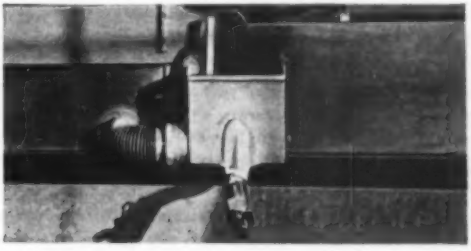
NEWS ABOUT FLEXIBLE METAL CONNECTORS
Here they offer HEAT RESISTANCE, PROTECTION, and ECONOMY



HEAT RESISTANCE The "electric hot topping" process generates a lot of heat. Braeburn Alloy Steel Corp. uses American Flexible Galvanized *Steel* Tubing to protect wiring from both this intense heat and impact. American Flexible Connectors can also be made from other metals. Use American Flexible Metal Connectors if your product must move, bend, vibrate, or resist heat, cold or pressure.



PROTECTION American Flexible Shielding Conduit was used on this motion picture film reduction printer. The manufacturer, Oscar F. Carlson Co., desired to protect wiring from crushing and impact. American Flexible Metal Connectors are often the easy solution to a tough design problem. They absorb vibration, protect flexible shafts, connect moving lines, and can be assembled in restricted spaces.



ECONOMY This American Flexible 2" ID Seamless Bronze Tubing is used between flue pan and syruping-off box on a maple syrup evaporator. The George H. Soule Co. chooses this connection because it permits more rapid flow of sap, and absorbs expansion and contraction. To carry air, oil, gases, grinder dust, and many other fluids and semi-solids—American Flexible Metal Connectors should be *your* first choice, too!

Write for Booklet SS-50: shows how the tubing is designed, used and installed – gives specifications on tubing and fittings. The American Brass Company, American Metal Hose Branch, Waterbury 20, Connecticut. In Canada: The Canadian Fairbanks-Morse Co., Ltd.

ANACONDA

wherever connectors must move... *American* flexible metal hose and tubing

for FRUGAL FIRING

SUPERIOR STEAM GENERATORS

fired with **SUPERIOR** ROTARY BURNERS

Burn OIL or GAS or *Both*

"Built for each other" is the phrase which best describes the combination of Superior Steam Generators with Superior Rotary Burners . . . and their performance record proves it. Because each is designed to supplement the other, the combination results in combustion efficiencies that spell maximum fuel economy.

Where combination gas/oil burners are employed, a specific advantage of Superior Burners lies in the ease and simplicity of changing from either fuel to the other. The changeover takes but a minute or so without disconnecting any piping, and without interruption of steam supply.

Superior Rotary Burners are fully automatic, burning the heaviest catalytic fuel oils. Gas burners burn any type of natural, manufactured, or bottled gas. Owners of Superior combination gas/oil burners can profit from the slightest fluctuation in the price of either fuel . . . switching from one to the other as economy dictates.

Superior Steam Generators are manufactured in 18 sizes, ranging from 20 to 600 b.h.p. for pressures to 250 p.s.i., or for hot water.

For complete details write for Catalog 402.

Sound fundamentals contribute to the high operating efficiencies of Superior Rotary Burners.

- Time-tested horizontal-rotary design.
- V-Belt Drive for the high cup speed essential to efficient atomization.
- Four-Hole Hinge circulates oil through oil heater so that hot oil is on the *pressure* side of the pump, allowing you to burn oil at higher temperatures.
- Adjustable Air Nozzle provides accurate control of flame contour.
- Dual Pumps and Reservoir combined with Constant Oil Rate Control provide controlled firing regardless of viscosity variation.
- Fully automatic with dual ignition, and hi-low or fully modulating control.

for performance you can **BANK** *on*

SUPERIOR COMBUSTION INDUSTRIES INC.
TIMES TOWER, TIMES SQUARE, NEW YORK 18, N.Y.

SUPERIOR STEAM GENERATORS

3 *special departments featured monthly to give you FREE bulletins, catalogs and product data screened for your personal interest in*

ENGINEERED PLANT SERVICES

1. NEW EQUIPMENT

Begins on page 8

Contains highlights of new products by leading manufacturers, briefed and illustrated for your easy reference. Complete data on each of these products are available ***free.***

2. NEW BULLETINS

Begins on page 148

Includes descriptions of only those bulletins and catalogs that are really ***new*** and of ***direct value*** to you — saves your reading time, yet gives you full service. All bulletins sent to you ***free*** on request.

3. READERS GUIDE TO ADVERTISED PRODUCTS

Begins on page 133

Designed to catalog advertised products for your convenience in finding the ads which are of special interest to you at this time. Also lists those important bulletins, catalogs and working data offered ***free*** in the advertisements.

REQUEST CARD FOR LITERATURE OR MORE INFORMATION—Oct., 1952

To: INDUSTRY AND POWER, St. Joseph, Mich. Please have forwarded to me, at no obligation, the literature I've indicated by the following key numbers:

New Equipment begins Page 8	*New Bulletins begins Page 148*	*Advertised Products begins Page 133*
No.'s	No.'s	No.'s

Your Name _____ **Title** _____

Your Company _____

Co. Address (St. & No.) _____

City _____ **State** _____

Inquiries for items listed in this issue not serviced beyond February 1, 1953

FIRST CLASS
PERMIT No. 19
(Sec. 34.9, P.L.&R.)
ST. JOSEPH, MICH.

BUSINESS REPLY CARD
NO POSTAGE STAMP NECESSARY IF MAILED IN THE UNITED STATES

3¢—POSTAGE WILL BE PAID BY

INDUSTRY AND POWER

420 MAIN STREET

ST. JOSEPH, MICH

3 *special departments featured monthly to give you FREE bulletins, catalogs and product data screened for your personal interest in*

ENGINEERED PLANT SERVICES

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City _____ **State** _____

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Readers' guide to advertised products

This department is both a product index for advertising and a keyed listing for advertised literature. Refer to advertisement on page indicated and contact advertiser directly — or list paragraph key numbers on reader service card (page 131) to get data you want

AIR & DUST FILTERS & COLLECTORS

Dust Collecting System **500**
Information available on Schneible multi-wash dust collecting system. Claude B. Schneible Co. p 164.

Dust Collector **501**
"LR" bulletin contains data on the new Buell "LR" dust collector. Buell Engineering Co. p 142.

Dust Collectors
Adv. p 128 contains information on Aerotec design 3 RAS dust collector. The Thermix Corp.

ANTI-CORROSIVE & PROTECTIVE COATINGS

Rust Preventive **502**
Adv. p 47 contains coupon for complete information on Rust-Oleum sealing compound. Rust-Oleum Corp.

BOILERS & BOILER ACCESSORIES

Steam Generators **503**
Information available on your steam general requirements. Foster Wheeler Corp. p 55.

Continuous Blowdown **504**
Cat No. 68-J and continuous blowdown check-chart available. Strong, Carlisle & Hammond Co. p 145.

Steam Generators **505**
Descriptive literature available on Wickes steam generators. The Wickes Boiler Co. p 165.

Vertical Unit Boilers
See adv. p 29 for information on C-E vertical unit boilers. Combustion Engineering-Superheater, Inc.

BUILDING HEATING, VENTILATING, AIR CONDITIONING & REFRIGERATION

Heavy-Duty Cleaners **506**
Complete details on G-E heavy-duty cleaning equipment. General Electric Co. p 146.

Unit Heaters
Adv. p 54 contains information on Trane unit heaters and diffusers. The Trane Co.

BUILDING MATERIALS & MAINTENANCE

Maintenance Handbook **507**
40-page handbook on commutator and slip ring maintenance. Ideal Industries, Inc. p 153.

Metal Gratings
See adv. p 122 for metal gratings for all types of floors. Klemp Metal Grating Corp.

Iron Cement **508**
Coupon p 163 offers free repair handbook describing Smooth-On repairs. Smooth-On Mfg. Co.

Steel Grating **509**
Bull 2365 contains data on electroforged steel grating. Blaw-Knox Div., Blaw-Knox Co. p 145.

Floor Patch **510**
Send coupon on p 160 for complete details of trial order plan and handbook of building maintenance. Flexrock Co.

Pipe Joint Compound **511**
Free sample of Key-Tite water proof sealing compound. Key Co. p 162.

COAL, ASH & BULK HANDLING

Conveyor Belting
Adv. p 125 contains information on Republic Rubber's coal handling conveyer belt. Republic Rubber Div., Lee Rubber & Tire Corp.

Electric Vibrators **512**
Illustrated folder available on Syntron electric vibrators. Syntron Co. p 147.

Hopper Accessories **513**
Illustrated folders contain data on Syntron hopper level switches, electric vibrators and flow control valves. Syntron Co. p 153.

Conveying System
Adv. p 52 contains data on the Fuller-Kinyon conveying system for dry pulverized materials. Fuller Co.

Ash Removal Systems **514**
Information available on National pneumatic steam ash removal systems. National Conveyors Co., Inc. p 155.

COMPRESSORS

Compressors
See adv. p 4 for information on Clark multi-stage centrifugal compressors. Clark Bros. Co., Div. of Dresser Operations, Inc.

Compressor **515**
Bull 766 contains information on the CP Class Y compressor. Chicago Pneumatic Tool Co. p 32.

Industrial Air Compressors **516**
Full details available on Schramm industrial air compressors. Schramm, Inc. p 151.

CONTROLS, REGULATORS & INSTRUMENTS

Instruments
Adv. p 159 contains information on Weston switchboard instruments. Weston Electrical Instrument Corp.

Tank Gage **517**
Details available on Liquidometer tank gage. The Liquidometer Corp. p 141.

Combustion Guide Instruments **518**
Adv. p 50 offers bulletins describing Hays combustion guide instruments. The Hays Corp.

Flat Glass Gages
See adv. p 120 for information on flat glass gages. Jerguson Gage & Valve Co.

Regulators **519**
Bull 350 contains complete details on Spence's line of automatic regulating valves. Spence Engineering Co., Inc. p 137.

Regulators **520**
Bull 316 gives full details on Powers Accritem regulators. The Powers Regulator Co. p 108.

(Continued on page 134)

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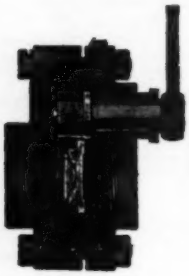
Water Treatment 142

EVERLASTING VALVES

mean "Everlasting" Protection on these duties

GENERAL SERVICE

Wherever frequent use and quick operation is required for any liquid or gas at pressures up to 300 psi. These valves have outside stuffing box and gland.



STEAM JACKETED

Assure continued free flow of any material which congeals at ordinary temperatures.

FIRE PROTECTION

Closing type for inflammable liquid emergency shut-off, or opening type for deluge or drainage, assuring immediate and positive action with weighted pendulum stop.

BOILER BLOW-OFF

Quick-opening, also hand-wheel operated, Angle and "Y" types meeting ASME Code requirements for pressures up to 600 psi.

BOILER WATER COLUMN

With indicator and locking device. Meets ASME Code requirements.

EVERLASTING FEATURES

For more than 40 years, EVERLASTING VALVES have been known for their ingenious design, simple sturdy construction, and long trouble-free life with low maintenance expense. Some of their distinctive features are:

Quick Action . . . opened or closed with less than a quarter turn of the operating lever.

Straight-Through Flow . . . the disc cannot become loose and accidentally check the flow.

Drop-Tight Seal . . . constant contact of disc and seat at all times prevents dirt or scale from getting between.

Self Regrinding . . . the disc rotates on the seat with each operation, thus regrinding the sealing surfaces.

No Wedge Action . . . all parts move between parallel faces.

Write for bulletin describing EVERLASTING VALVES in detail.

EVERLASTING VALVE COMPANY, 49 Fisk Street, Jersey City 5, N. J.

Everlasting Valves

Trade-Mark "EVERLASTING" REG. U. S. PAT. OFF.

for everlasting protection

Readers' guide to advertised products

(Continued from page 133)

DIESELS

Diesels

Adv. p 9 contains data on Cooper-Bessemer diesels. The Cooper-Bessemer Corp.

ELECTRICAL DISTRIBUTION

Circuit Breakers **521**

Bulletin with facts on "What You Should Know about Circuit Breakers." Heineman Electric Co. p 117.

Circuit Breakers

Adv. p 106-107 contains information on molded case circuit breakers. I-T-E Circuit Breaker Co.

Unit Substations **522**

Cat Sec 9000 contains complete data on I-T-E unit substations. I-T-E Circuit Breaker Co. p 18-19.

ENGINES

Engines

Full facts available on Worthington dual fuel engines. Worthington Corp., Engine Div. p 149.

FANS & BLOWERS

Fans & Blowers **523**

Coupon in adv. p 2 will bring information on Hartzell fans and blowers. Hartzell Propeller Fan Co.

Ventilators **524**

Coupon p 33 offers complete data on Coppus ventilators. Coppus Engineering Corp.

Exhaust Fan

Information on Gallaher air van power exhauster for expelling moisture and fumes. The Gallaher Co. p 160.

FILTERS, STRAINERS & PURIFIERS

Flo-Klean Strainers **525**

Coupon on p 123 contains data on Cuno Flo-Klean strainers. Cuno Engineering Corp.

Twin Strainers **526**

Bulletin contains service-giving features of Elliott twin strainers. Elliott Co., Accessories Dept. p 150.

FUELS & FIRING EQUIPMENT

Fuel Oil Units **527**

Bull OB-37 contains details on Enco fuel oil pumping and heating units. The Engineer Co. p 40.

Coal

See adv. p 160 for information on this product. General Coal Co.

Burner

Adv. p 59 contains information on the John Zink smokeless field flare burner. John Zink Co.

Pulverizer

Adv. p 20-21 contains information on the Riley "50" pulverizer. Riley Stoker Corp.

Coal

See adv. p 16-17 for information on bituminous coal. Bituminous Coal Institute.

Spreader Stokers **528**

Coupon p 31 offers full information on Perfect spread stokers and Caterpillar installation story. American Engineering Co.

(Continued on page 136)

For its
Contra Costa plant

PACIFIC GAS AND ELECTRIC COMPANY

uses a

GRAVER

Hot Process Softener

This utility, like many others in every section of the country, uses a Graver Hot Process Softener for treating the feedwater to high-pressure boilers.

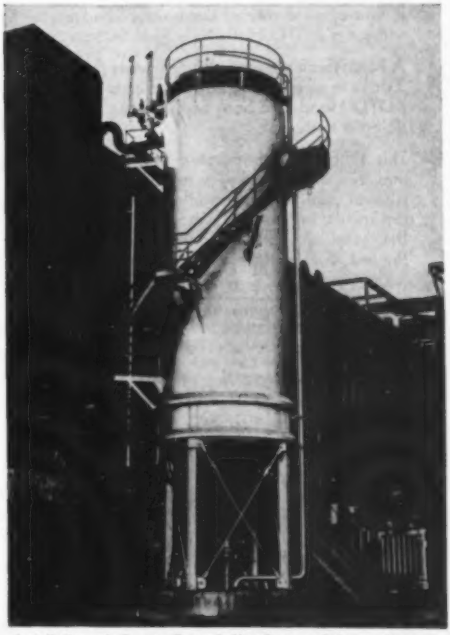
The wide popularity of these Graver units is due to many important advantages.

FOR EXAMPLE:

- **smaller diameter tank for lowest upward settling rate, with resulting economies in cost of tank and installation.**
- **greatest clear settling height, which, together with the low upward settling rate, assures thorough clarification of the treated water.**
- **dual automatic desludging system which protects the boilers from carryover of sludge upon rapid increase in load.**
- **lime feeding system which minimizes deposits in chemical lines.**

In service, Graver Hot Process Softeners reduce both total hardness and silica to the exceedingly small amounts allowable for high-pressure boilers; and clarity of effluent is maintained in many installations *without requiring filters.*

You, too, can depend upon Graver for effective and economical water conditioning. Be sure to consult Graver on your water problem.



Installation of Graver Type S Hot Process Softener for pre-evaporator treatment of 125,000 pounds per hour of feedwater to 1400 psig boilers at the Contra Costa Station of Pacific Gas & Electric Co. in California.

Visit our Booth 541-542 at the Power Show, New York, December 1-6, 1952

GRAVER **GRAVER WATER CONDITIONING CO.**

Division of Graver Tank & Mfg. Co., Inc.

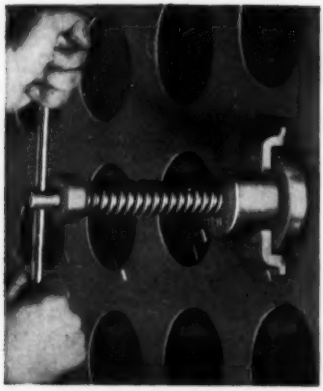
DEPT. IP-HP, 216 WEST 14th STREET, NEW YORK 11, N. Y.

In Canada: The Bird-Archer Co., Ltd.; Cobourg, Ontario

In Mexico: Proveedores Tecnicos, S.A.; Puebla 259, Mexico 7, D. F.

GW 429

48 man-hour job done in only 4 hours with a ROTO Hand-hole Seat Scraper



Illustrating ease of operation of Roto Hand-hole Seat Scraper.

If you operate any of the boilers listed below, you can't afford to be without a ROTO Hand-hole Seat Scraper.

A Pennsylvania manufacturer reports that it formerly took three men 2 to 3 days to clean inside cap seats on a Keeler Boiler header. Now, with a ROTO Hand-hole Seat Scraper, one man does it in four hours, besides doing a better job.

This simple, hand-operated tool is equipped with retractable knives mounted on the end of a revolving spindle having a bearing in a substantial yoke. An adjustable spring automatically maintains tension on the knives, sufficient to remove all foreign matter but not enough to cut the metal. A few turns to the right, and the job is done. A half turn to the left releases the tool. Write for bulletin and prices.

MAKE OF BOILER	TUBE SIZE	OPENING
Babcock & Wilcox	4"	Oval
B. & W. No. 40 Header	3¼"	Oval
B. & W. No. 41 Header	2"	Oval
B. & W. Superheater	2"	Round
Babcock & Wilcox	4-13/16x5"	Square
Casey Hedges	4"	Oval
Casey Hedges	3½"	Oval
Combustion Engineer'g	3"	Round
Edge Moore	4"	Oval
Franklin	4"	Round
Geary	4"	Oval
Heine	3½"	Oval
Heine	3½"	Round
Keeler	4"	Round
Keeler	4"	Diamond
Murray	4"	Oval
Murray	3½"	Oval
Oil City	4"	Oval
Oil City	3½"	Oval
Union Iron Works	4"	Pear Shape
Walsh & Widener	4"	Oval

Roto Hand-hole Seat Scraper for Heine Boiler.

ELLIOTT COMPANY-ROTO DIVISION
156 Sussex Avenue Newark 1, N. J.

Readers' guide to advertised products

(Continued from page 134)

HEAT EXCHANGER EQUIPMENT

Instantaneous Water Heaters **529**
Engineering data available on instantaneous water heaters. Pick Mfg. Co. p 116.

INSTRUMENTS FOR MEASURE OF ELECTRICITY

Electric Temperature Control **530**
Bulletins 1025 and 1080 contain complete story of Sarco electric temperature control. Sarco Co., Inc. p 111.

LUBRICANTS, LUBRICATION, OIL FILTERS & PURIFIERS

Rubilene Oil
Adv. p 42, 43 contains information on Sinclair Rubilene oil. Sinclair Refining Co.

Oil Purifiers **531**
Literature describes complete line of Hilco purifiers, filters, reclaimers and conditioners. The Hilliard Corp. p 143.

Colloidal Graphite **532**
Bull 426-17K contains data on "dag" colloidal graphite for metal-working operations. Acheson Colloids Co. p 57.

Lubricant
Adv. p 65 describes Standard HD oil. Standard Oil Co. (Indiana).

Oil Filters
Adv. p 143 contains data on Winslow oil filters. Winslow Engineering Co.

Lubrication Systems
Specialists in lubrication, filtration, oil storage, metering for industry. Bowser, Inc. p 60.

Lubricant **533**
Coupon p 105 offers literature on "Sunvis H.D. 700 Oils". Sun Oil Co.

Force Feed Lubrication
Adv. p 154 describes Manzel force feed lubrication. Manzel, Inc.

Non-Fluid Oil **534**
Complete information and samples available of Non-Fluid Oil for pneumatic tools and equipment. New York & New Jersey Lubricant Co. p 147.

MATERIALS OF CONSTRUCTION

Nickel Alloy **535**
24-page reference manual, "Engineering Properties of 'K' Monel and 'KR' Monel." The International Nickel Co., Inc. p 56.

MECHANICAL POWER TRANSMISSION

Conveyor Belts
Consult the Goodyear Technical Man for your needs in conveyer belts and other industrial rubber products. Goodyear Tire & Rubber Co. p 3.

Grommet V-Belts
Adv. pages 35-38 discuss Goodrich grommet belts. The B. F. Goodrich Co., Industrial Products Div.

Flexible Couplings **536**
Catalog and quick-finding selector charts on Lovejoy flexible couplings. Lovejoy Flexible Coupling Co. p 153.

Roller Bearings
Adv. p 28 contains information on Hyatt roller bearings. Hyatt Bearings Div., General Motors Corp.

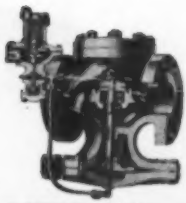
(Continued on page 138)

Looks like we're using **SPENCE REGULATORS** *all over our plant*

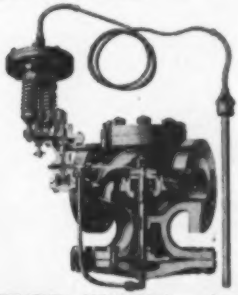
This busy plant has ordered and re-ordered Spence Regulators for two good reasons. (1) Spence offers a *wide-range line* to handle a host of regulating jobs. (2) What's more, Spence units give accurate service year after year. Maintenance is negligible. Over-all costs are low. These design features explain why . . .

- **Single Seat Packless Construction**
- **Large Balanced Metal Diaphragm**
- **Sensitive Pilots**
- **SECO Metal Seats and Discs**
- **Springs out of path of steam**
- **No dismantling for inspection**

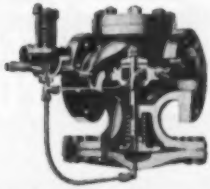
Write for Bulletin 350 for complete details on Spence's line of automatic regulating valves.



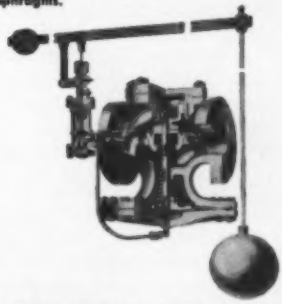
PRESSURE REDUCING—Self-operated, dead-end regulators powered by large, frictionless, metal diaphragms. Sizes ¼ in. to 12 in. Pressures to 600 psi 750F.



TEMPERATURE REGULATING — Combined temperature and pressure control. No separate reducing valve required. Shuts tight, will not wiredraw or be damaged by overheating. Sizes to 12 in.



BACK PRESSURE CONTROL—Wide selection of sensitive pilots to meet exacting requirements. Initial pressure closing, guaranteed to shut tight. Packless construction, metal diaphragms.



LEVER OPERATED—Pilot lever for connection by cable or mechanical linkage to floats or other devices. Slight actuator motion opens and closes main valve.

SPENCE ENGINEERING COMPANY, INC.
WALDEN, NEW YORK

Spence

handle
ALL pulling jobs
swiftly...easily...safely
with
Snap-on
INTERCHANGEABLE
PULLER TOOLS

With a minimum investment in pullers and adaptor units, you're set to handle every pulling job in the plant—swiftly and easily—with safety to the workman and the work. Snap-on puller sets offer an unusually wide range of interchangeability, giving substantial savings in initial cost. The Industrial Puller Set illustrated, CG-608, will handle all puller operations encountered in most shops—size capacity up to 14" diameter with power up to 20 tons.

Write for the Snap-on Industrial Catalog and general catalog of 4,000 hand and bench tools. A nearby Snap-on factory warehouse is ready to give you immediate service on all your tool requirements.

SNAP-ON TOOLS CORPORATION
8102- 28th AVENUE, KENOSHA, WISCONSIN

*Snap-on is the trademark of Snap-on Tools Corporation

Readers' guide to advertised products

(Continued from page 136)

Steel Collars **537**
Literature describes solid steel collars. Hallowell Power Transmission Div., Standard Pressed Steel Co. p 157.

PACKAGED STEAM GENERATORS

Packaged Steam Boilers **538**
Illustrated and descriptive Cleaver-Brooks steam boiler catalog available. Cleaver-Brooks Co. p 41.

Preferred Unit Steam Generator **539**
Features of the unit are described in Bull 2000. Preferred Utilities Mfg. Corp. p 121.

Steam Generators **540**
Coupon p 126 offers catalog on Clayton forced recirculation steam generators. Clayton Mfg. Co.

Packaged Boilers **541**
Econotherm and Economist Bull EC-100B describe Dutton packaged boilers. Free steam cost calculator. Hapman-Dutton Co., Dutton Boiler Div. p 115.

Superior Steam Generators **542**
Cat 402 contains complete details on Superior packaged steam generators. Superior Combustion Industries, Inc., p 130.

PACKING & GASKETS

Mechanical Seal **543**
Bull 1741P contains complete data on mechanical sealing. Durametallic Corp. p 155.

PIPE AND FITTINGS

Flexible Metallic Tubing **544**
Illustrated folder "Flexineering" contains data on Penflex tubing. Pennsylvania Flexible Metallic Tubing Co., Inc. p 139.

Steam Hose
See adv. p 45 for information on Hy-Test steam hose. New York Belting & Packing Co.

Wing Unions **545**
Catalog contains data on complete line of wing unions. Weil Equipment Mfg. Co. p 145.

Flexible Metal Hose **546**
Literature available on the CMH line of flexible metal hose. Chicago Metal Hose Div., Flexonics Corp. p 62.

Flexible Metal Connectors **547**
Booklet SS-50 describes American flexible metal connectors and their uses. The American Brass Co., American Metal Hose Branch. p 129.

PUMPS

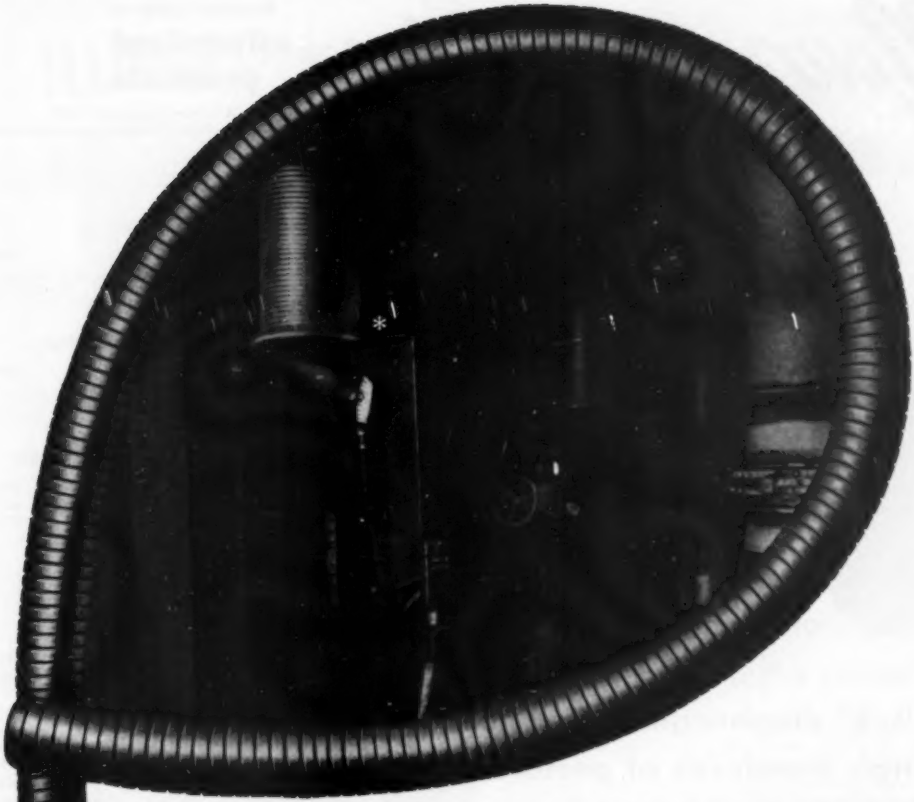
Vertical Turbine Pumps
Adv. p 48 contains information on Worthington vertical turbine pumps. Worthington Corp., Vertical Turbine Pump Div.

Condensation Return Units **548**
Bull 113-ST describes packaged condensation return units with No. 4 series Apco pumps. Aurora Pump Co. p 143.

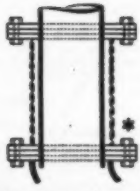
Peerless Pumps **549**
Adv. p 119 contains coupon offering bulletins on Peerless pumps. Peerless Pump Div., Food Machinery & Chem. Corp.

Pumps
See adv. p 144 for information on American-Marsh pumps. American-Marsh Pumps, Inc.

(Continued on page 140)



HELPS "PIPE DANCE" IN BOILER OPERATION



(Cross-sectional view, showing Penflex tubing encasement on steel feed pipes from hopper.)

PENFLEX TUBING ABSORBS THERMAL EXPANSION

When a large public utility power plant fed powdered coal into burners of high-pressure steam boilers, thermal expansion moved steel feed tubes around, showering coal dust over equipment.

Penflex tubing was recommended as an outer protective encasement for the rigid steel tube that comes down from the hopper. Lengths of 20' & 24' I. D. interlocking, galvanized steel tubing were installed. Now the steel pipes from the hopper virtually "float" at one end when thermal expansion occurs. Penflex tubing forms a flexible seal between hopper and tube, assuring protected delivery of powdered fuel.

Let Penflex engineers help you on flexible tubing application problems. Penflex manufactures a complete line of four wall, interlocking and seamless welded corrugated flexible tubing . . . metallic hose, tubing or couplings from ⅛" I. D. and up . . . automatic barrel fillers, pneumatic rivet passers, accessories and fittings. Write for folder, "Flexineering," a valuable production aid.

Pennsylvania Flexible Metallic Tubing Company, Inc., 7238 Powers Lane, Phila. 36, Pa.

Branch Sales Offices: **Boston • New York • Chicago • Houston • Cleveland • Los Angeles**

penflex

HEART OF INDUSTRY'S LIFE LINES

Copyright 1951 Penna. Flexible Metallic Tubing Co., Inc.

Now available

a new improved plastic diaphragm . . .

"L-2" diaphragms offer new high standards of performance in many severe services

For a wide variety of severe services, including the valving of 66° Bé sulfuric acid, the new, improved "L-2" diaphragm offers physical and service characteristics never before available. Like its predecessor, the "L-1", the "L-2" diaphragm is made of polyethylene specially compounded to provide high resistance to strong acids and other highly active materials.

Hills-McCanna diaphragm valves with "L-2" diaphragms are available with a choice of manual, remote or automatic operators and with bodies of any machinable alloy or with rubber, Neoprene, glass or lead linings. Sizes range from ⅜" through 14". "L-2" diaphragms permit operation at temperatures to 125°F and pressures to 100 psi. Other diaphragms available are Kel-F, Neoprene, rubber, Hycar, Tygon, and butyl. Depending on material, these may be used at pressures to 150 psi, temperatures to 220°F.

Write for complete details. HILLS-McCANNA CO., 2355 W. Nelson St., Chicago 18, Ill.

HILLS-McCANNA

saunders patent diaphragm valves

Also Manufacturers of Proportioning Pumps

Force Feed Lubricators • Magnesium Alloy Castings

Readers' guide to advertised products

(Continued from page 138)

Pumps

Adv. p 114 contains information on Weinman pumps. The Weinman Pump Mfg. Co.

REFRACTORIES

Refractories **550**

Adv. p 12, 13 contains coupon for new booklet describing principal properties of super refractories. Refractories Div., The Carborundum Co.

REFRACTORY CONCRETES

Insulating Cement **551**

Coupon in adv. p 152 offers catalog, prices and free sample of Stic-Tite insulating cement. Refractory & Insulation Corp.

SOOT BLOWERS & TUBE CLEANERS

Tube Expanders **552**

Bull 380 contains complete data on Wilson tube expanders. Thomas C. Wilson, Inc. p 141.

Tube Expanders

See adv. p 144 for information on triple-purpose tube expanders. The Gustav Wiedeke Co.

STEAM SPECIALTIES

Bucket Traps **553**

Full information available on Hoffman bucket traps. Hoffman Specialty Co. p 118.

Steam Traps **554**

Cat 690 contains data on traps. Also data on separators (Cat 500) and boiler trim (Cat 700). Wright-Austin Co. p 124.

Impulse Steam Traps **555**

Bull T-1740 contains information on Yarway impulse steam traps. Yarnall-Waring Co. p 66.

Illinois Steam Traps **556**

Bull 35 contains data on Illinois steam traps. Illinois Engineering Co. p 141.

Steam Traps **557**

Coupon on p 166 offers book "Solving Steam Trap Problems". The V. D. Anderson Co

TANKS

Tank Controls

See adv. p 113 for information on Johnson tank controls. Johnson Corp.

THERMAL INSULATION

Insulating Cement **558**

Coupon on p 157 contains complete data on Black Rockwell insulating materials. Baldwin-Hill Co.

Heat Insulation

Adv. p 63 contains data on Kaylo heat insulation. Owens Illinois Glass Co., Kaylo Div.

TOOLS

Hand-hole Seat Scraper **559**

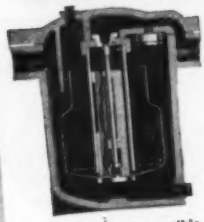
Bulletin and prices available on Roto hand-hole seat scraper. Elliott Co., Roto Div. p 136.

Snap-On Tools **560**

Industrial and general catalog of 4,000 hand and bench tools. Snap-On Tools Corp. p 138.

(Continued on page 142)

ILLINOIS Steam Trap



Simple — has only two moving parts

Valve Stem Travels Independent of Bucket — no other trap has this feature.

Instantaneous Valve Action — either wide open or tight shut — will not dribble on partial closing of valve under slow condensation rates.

Wire Drawing Impossible — valve has snap action.

Simple — moving parts are valve and bucket.

Cannot Air Bind — vents air continuously without loss of steam.

Cannot Blow Steam — always water sealed.

Surface Discharge—flushes out all grease and sludge.

Valve Seat — of special alloy, fully guaranteed.

Inspection Easy — without disturbing piping.

Works Equally Well on All Fluids — compressed air lines, air separators, air aftercoolers.

Write for Bulletin 35

Consult us on your requirements

ILLINOIS ENGINEERING COMPANY

INCORPORATED 1922

RACINE AVENUE AT 21ST STREET • CHICAGO 8

"LIQUIDS WORTH STORING ARE WORTH MEASURING"

with a

LIQUIDOMETER

Tank Gauge

- FOR GAUGING LIQUIDS OF ALL KINDS
- 100% AUTOMATIC
- APPROVED BY UNDERWRITERS' LABORATORIES

THE LIQUIDOMETER CORP.

36-32 SKILLMAN AVE., LONG ISLAND CITY, N.Y.

WILSONIZE to economize

This CURVE-TUBE MOTOR

gives up to 40% more power while "taking the curves"

Here is a curve-tube motor with real power. The Wilson ECT Series Air Motor "takes the curves" easily . . . does an efficient cleaning job. Size-for-size, the ECT has developed up to 40% more power than ordinary motors. These design features tell why: automatic valving of operating air, six-blade rotor, special lightweight blades.

You get these important advantages: (1) higher torque at any speed because of six-bladed construction; (2) less air consumption with a minimum of back pressure; (3) positive starting—hard to stall; (4) less downtime because tube cleaning jobs are faster, more thorough; (5) saves on labor and keeps production up; (6) no extra cost.

WILSON *Tube Expanders Insure firm seating*

They have a smooth, parallel rolling action that insures firm seating of the tube . . . gives you tighter, perfectly rolled joints. There is a Wilson Tube Expander for every need, from 3/16" ID to 12" ID. Bulletin 380 on request.

TW 804

THOMAS C. WILSON, INC.

21-11 44th AVENUE, LONG ISLAND CITY 1, N. Y.

Representatives in all principal cities

CABLE ADDRESS: "TUBICLEAN", NEW YORK

WILSON

TUBE CLEANERS • TUBE EXPANDERS

NEWS–for Plant Engineers about an efficient Dust Collector for Boilers from 100 to 2000 BHP!

IT'S THE NEW BUELL 'LR' FLY ASH COLLECTOR

Now! Get 99% of all cinder discharge –100-mesh and larger! The 'LR' collector–with low draft loss–is extremely effective on *natural*, as well as *forced* draft installations. For more information on how the new Buell 'LR' Dust Collector will help solve your Fly Ash problem, write today for the new 'LR' bulletin.

Buell Engineering Company, Dept. 90-J,
70 Pine Street, New York 5, N. Y.

buell®

Engineered Efficiency in **Fly Ash Collection**

(Continued from page 140)

Tube Rolling Control **561**
Descriptive literature available on Airetool tube rolling control. Airetool Mfg. Co. p 156.

TURBINES

Steam Turbines
Adv. p 49 contains information on Worthington steam turbines. Worthington Corp., Steam Turbine Div.

Turbines **562**
Bull S-146 contains information on Terry multistage turbines. The Terry Steam Turbine Co. p 44.

Turbines
Adv. p 61 contains information on Type E turbines. Westinghouse Electric Corp.

VALVES

Butterfly Valves **563**
Valve catalog contains data on Rockwell butterfly valves. W. S. Rockwell Co. p 155.

Valves **564**
Catalog gives 4 ways to cut pump repairs. Sims Pump Valve Co., Inc. p 162.

Silent Check Valves **565**
Bull WH-851 on "Water Hammer, Cause, Effect and Control in Piping Systems". The Williams Gauge Co. p 147.

Gate Valves **566**
Cat 12-E contains details on Edward gate valves. Edward Valves, Inc. p 53.

Corrosion-Resistant Valves
See adv. p 26 for information on Aloyco corrosion-resistant valves. Alloy Steel Products Co., Inc.

Gate Valves **567**
Descriptive bulletin available on Darling revolving disc gate valves. Darling Valve & Mfg. Co. p 127.

Diaphragm Valves **568**
Complete details available on Hills-McCanna Saunders patent diaphragm valves. Hills-McCanna Co. p 140.

Check Valves **569**
Cat 30 contains complete information on Chapman tilting disc check valves. Chapman Valve Mfg. Co. p 64.

Gate Valves
See adv. p 58 for data on Vogt drop forged steel gate valves. Henry Vogt Machine Co.

Pressure Regulator Valve
Adv. p 7 contains information on No. 960 pressure regulator Valve. Crane Co.

Everlasting Valves **570**
Bulletin describes Everlasting valves in detail. Everlasting Valve Co. p 134.

Blow-Off Valves **571**
Bulls B-424 and B-433 contain complete information on Yarway seatless blow-off valves. Yarnall-Waring Co. p 24, 25.

WATER TREATMENT

Water Treatment Plants **572**
Bulletins available on manual and automatic water treatment plants. Hungerford & Terry, Inc. p 163.

Water Conditioning
Information on Elgin water conditioning systems for every need. Elgin Softener Corp. p 23.

(Continued on page 144)

HILCO LUBE and FUEL OIL PURIFICATION - - -

OIL RECLAIMER

FILTER

15 YEARS CONTINUOUS OPERATION WITHOUT OIL CHANGE IN DIESEL AND GAS ENGINES—NEGLIGIBLE PISTON AND CYLINDER WEAR.

THIS IS THE RESULT OF COMPLETE PURIFICATION—THE REMOVAL OF SLUDGE, CARBON, ACIDS, WATER, AND FUEL DILUTION.

HILCO UNITS IN OPERATION LONG ENOUGH TO PROVE THEIR VALUE. ONE-QUARTER CENTURY OF EXPERIENCE IS AT YOUR SERVICE.

- PURIFIERS
- FILTERS
- RECLAIMERS
- CONDITIONERS

THERE IS A **HILCO** FOR EVERY LUBRICATION AND FUEL OIL FILTERING PROBLEM - - -

YOU WANT CLEAN OIL AND CLEAN ENGINES TO SAVE EQUIPMENT—OIL AND MONEY—INVESTIGATE HILCO OIL MAINTENANCE METHODS.

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APCO *Packaged* CONDENSATION RETURN UNITS

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10 to 40 lbs. with 8, 15, 30 Gallon Receivers

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Start saving valuable heat units with APCO Square Tank Units. Built to meet demand for a smaller unit with the superb performance of our larger units. Remember, the Pumps are Apcos. No Vapor Binding — Special Provision for Expansion and Contraction — No Frictional Wear within pump. Thus, ECONOMY.

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Will roll and flare both ends of nipples up to 5" long. Reverse combination roll furnished is used when reaching through nipples.

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THE GUSTAV **WIEDEKE** COMPANY
DAYTON 1, OHIO

Readers' guide to advertised products

(Continued from page 142)

Softener System
Adv. p 135 contains information on Graver hot process softeners. Graver Water Conditioning Co.

Water Treatment
A chemical service organization. National Aluminate Corp. p 11.

Demineralizer **573**
Full information available on automatic Mono-Column demineralizer. Penfield Mfg. Co., Inc. p 157.

Water Treatment **574**
Information available on the use of organics for boiler water treatment. Power Chemicals Div., E. F. Drew & Co., Inc. p 51.

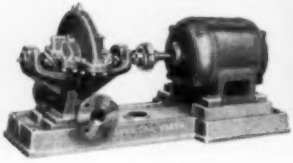
Water Conditioning Service **575**
Free Technical Paper No. 98 "Boiler Scale—Its Formation and Prevention". W. H. & L. D. Betz. p 15.

Water Conditioning System **576**
Bull W-212-B5 contains facts on Worthington cold process water softening method. Worthington Corp., Water Treating Sec. p 46.

Return Line Corrosion **577**
Bull 5013 outlines causes of return line corrosion and describes its control. Dearborn Chemical Co. p 39.

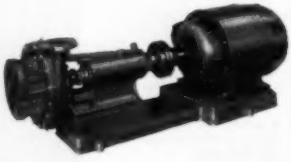
Boiler Water Comparator **578**
Handbook on "Modern pH and Chlorine Control." W. A. Taylor and Co. p 6.

—End



HOW TO SPECIFY THE RIGHT PUMP FOR LONG-TERM SATISFACTION . . .

Only the right pump can give you economy, performance and long service . . .



In a nutshell, the most important factor in pump specification is *exact* application "know-how."

A pump "adapted" to a particular job can't give you the high efficiency and long, trouble-free life you'll get from a pump *specifically built* for the purpose. In most cases, the pump you need is already in production. The problem is *how to find it.*

We suggest you call in your American-Marsh representative for specification suggestions. He'll give you honest, straightforward advice—based on his own and our factory engineers' experienced application "know-how." The result will be the *right pump for your job*—and long-term *service satisfaction for you.*

Pumps and Pumps Only Since 1873

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BATTLE CREEK MICHIGAN

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CENTRIFUGAL, TURBINE, STEAM AND POWER PUMPS FOR TESTING, PROCESSING, BOILER FEED, FIRE PROTECTION, ETC.

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Everyone walks safely, confidently on Blaw-Knox Electroforged Steel Grating . . . the one-piece panels stay rigid and strong—without shimmy or shake—because there are no parts to work loose. Twisted cross bars provide sure footing under the most adverse conditions. For complete information, write for Bulletin 2365.

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Industry's first choice for
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BLAW-KNOX ELECTROFORGED STEEL GRATING

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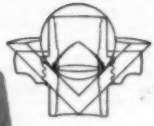
WECO... WING UNIONS



• Ball and cone seating of male and female sub provides unequalled sealing ability.

• Heavy acme threads on female sub and wing nut make up fast, resist damage and distortion.

• Sub walls are extra thick for protection against distortion, vibration, shock and surge pressures.

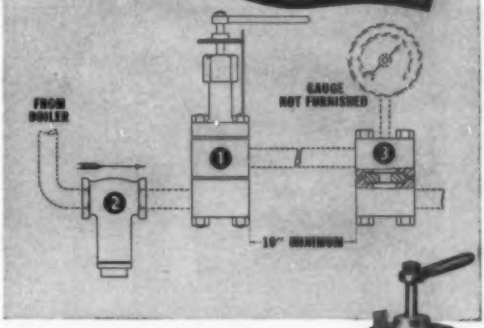
• Available in sizes 1" through 10"; test pressures from 1000 psi through 15,000 psi.

Ask your WECO or CHIKSAN Representative or write for WECO catalog of the most complete line of wing unions in the world.

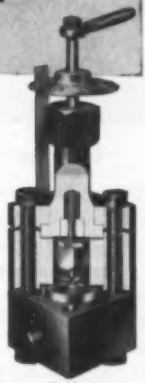
WECO

WELL EQUIPMENT MFG. CORP.
HOUSTON 1, TEXAS
CHIKSAN COMPANY

Custom-Built... CONTINUOUS BLOWDOWN



STRONG Dual-Orifice Assembly gives Greater Accuracy . . . Rugged Service!



Also available in outside screw and yoke.

Strong's Continuous Boiler Blowdown Assembly includes a Strong *block steel* Evrtyte* Valve (1), a strainer (2) and an orifice block (3), *custom-built* and accurately sized *for your own job conditions.*

The assembly is essentially two orifices arranged in series. The first orifice (valve) is variable . . . . the second is fixed. Correct proportioning of orifices provides extremely accurate control and reduces wire drawing.

Strong Evrtyte steel valves have special Anum-Metl X seats and discs of 750 Brinell surface hardness for long life. Available for pressures to 1500 psi and temperatures to 800° F. or 6000 psi non-shock cold service.

› Let us custom-size your continuous blowdown system. Send for Catalog No. 68-J and our Continuous Blowdown Check-Chart today!

*Reg. Trade Mark

STRONG, CARLISLE & HAMMOND COMPANY
1392 WEST 3rd Street
Cleveland 13, Ohio
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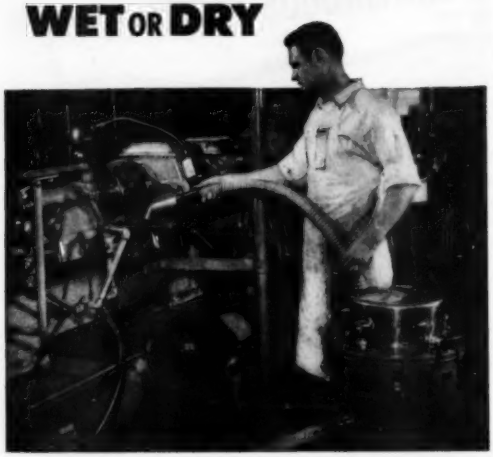
80 Series Trap

Strainer

STRONG

FOR *FAST, THOROUGH, CLEANING*

WET OR DRY



It's the G-E Heavy-Duty Cleaner

Try this G-E portable unit on your cleaning job — you'll find it without equal! Unskilled help takes to it in a hurry; and your janitorial department jumps in efficiency.

These compact G-E cleaners are powerful, with a full one horse-power vacuum unit. Their low weight, only 51 pounds, makes them easy to roll along aisles and around machinery. This flexibility of use minimizes disturbance of normal business operations.

Nozzles are extra wide for fast coverage of flat surfaces, while other attachments speed the cleaning of hard-to-reach areas. It takes only an instant to change the unit to a blower.

This G-E works just as well on wet cleaning—just needs a quick change from filter bag to wet pick-up container, and it's ready to gather suds, over-flow, and other slop.

Mail in the coupon for data on what the G-E can do for you.

Heavy-Duty Cleaning Equipment

GENERAL ELECTRIC

GENERAL ELECTRIC COMPANY, Dept. 22-4904
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Without obligation, please send complete details on heavy-duty cleaning equipment.

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NON-FLUID OIL

TRADE MARK REGISTERED

Stops Oil Showers from Crane Motors

Constant oil leakage from overhead crane motors results in high oil and application cost. Bearings must be filled frequently to insure protection from failure.

Drippage causes other heavy losses. Tracks and pillars must be cleaned to lessen fire hazard. Stock cleaning costs are increased when oil deposits must be removed.

NON-FLUID OIL stops such losses. Saves money because it does not drip or leak. You get better lubrication and clean products at lower cost.

Send for instructive bulletin and free testing sample of NON-FLUID OIL.

NEW YORK & NEW JERSEY LUBRICANT COMPANY

292 Madison Ave., New York 17, N. Y.
Works: Newark, N. J.

WAREHOUSES: Atlanta, Ga. • Greenville, S. C. • Charlotte, N. C. • Birmingham, Ala. Columbus, Ga. • Greensboro, N. C. • Providence, R. I. • Chicago, Ill. • St. Louis, Mo. Detroit, Mich. • Also represented in most industrial centers, including Cleveland, Ohio Cincinnati, Ohio • Pittsburgh, Pa. • Syracuse, N. Y.

NON-FLUID OIL is not the name of a general class of lubricants, but is a specific product of our manufacture.

SYNTRON

"Semi-Noiseless" ELECTRIC VIBRATORS

with variable control of power

Model V-60 Semi-Noiseless Vibrator eliminates material arching and plugging in hopper . . . saves time and equipment.

Assure Free-Flowing Bins, Hoppers and Chutes

Now, Syntron presents a complete line of Semi-Noiseless Electric Vibrators for use in installations located close to workers where noise is a major factor.

They operate the same as standard Syntron Vibrators—assure a smooth, controlled flow of material—prevent loss of costly time due to material coming 'short' on dependent operations and prevent loss of material due to 'surges'. New 'cushion' action provides a sharp reduction in the operating noise.

Write Today For FREE Catalog Folder

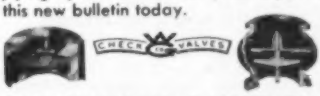
Flat Bottom Bin with Center Discharge | Wooden Hoppers | Concrete Hoppers | Inclined Chutes | Hopper with Sloping Discharge

SYNTRON COMPANY

425 Lexington Avenue Homer City Penna.

Get your copy of this NEW BULLETIN!

This important new Bulletin WH-851 explains in detail the causes and damaging effects of costly Water Hammer—and how it can easily be controlled with Williams-Hager Silent Check Valves. Learn how Water Hammer can be quickly and inexpensively controlled *in your piping system*—send for your copy of this new bulletin today.



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New bulletins and catalogs

Literature on engineering products and developments

Each new bulletin item has a key number for your convenience in asking for a free, personal copy. Insert key numbers on return post card found on page 131

AIR & DUST FILTERS & COLLECTORS

Cloth Type Filter **200**

Designed primarily for continuous process industries, a new cloth screen dust filter described in 8-page bulletin 102 is said to provide uniform suction at all dust points. How it works, application to existing systems, advantages and specifications are presented. A section entitled "How to Engineer a Dust Problem" presents information that should be of interest. The W. W. Sly Manufacturing Co.

BUILDING HEATING, VENTILATING & AIR CONDITIONING & REFRIGERATION

Unit Heaters **201**

Horizontal and vertical propeller fan type unit heaters, for operation with steam or hot water, are the subject of 20-page booklet 3322. How they are used and how they operate is discussed. Design, construction, advantages and specifications are presented. Tables list capacities from 25,000 to 600,000 Btu per hr. A variety of diffuser accessories also are described. American Air Filter Co., Inc., Herman Nelson Div.

BOILERS & BOILER ACCESSORIES

Boiler Tube Corrosion **202**

"How You Can Avoid Boiler Tube Corrosion," 8-page reprint TR-514, outlines the various types and causes of corrosion and lists proper operating and maintenance procedures to be followed for maximum service life of boiler tubing. The article indicates that corrosion is the largest single cause for tube replacement in low pressure boilers. The Babcock & Wilcox Co., Tubular Products Div.

Steam Generator **203**

Integral furnace, 2-drum steam generators are described in 16-page brochure. For oil, gas or stoker firing, the boilers are offered in a wide range of capacities and design pressures. Design features, advantages and construction, together with tube arrangements and dimensions, are given. Specifications are listed and installations are shown. Erie City Iron Works.

Liquid Level Gages **205**

Gages and valves for observation of liquids and levels are described in 4-page folder 180. Reflex, transparent, process and tubular glass gages, as well as special application units, are discussed. Accessories including gage valves and illuminators also are dealt with. Jerguson Gage & Valve Co.

BUILDING MATERIALS & MAINTENANCE

Floor Patch **206**

Holes, ruts, breaks and pitted areas in concrete floors can be repaired by an immediate setting floor patch described in a 4-page folder. Technical data on the product is presented. Flexrock Co.

Vacuum Cleaners **207**

Design and operating features of a redesigned line of industrial portable vacuum cleaners are outlined in 4-page folder 102-H. Standard electric, belt and gasoline driven units ranging from 3 to 15 hp are described. Specifications are listed in tables. The Spencer Turbine Co.

COAL, ASH & BULK HANDLING

Conveyer Belts **208**

How to select the proper conveyer belt for a specific job is discussed in an 8-page bulletin. Construction, application and engineering data are included for belts ranging from light materials handling to heavy duty applications. Common causes for failures also are given. Barber-Greene Co.

Conveyer Belting **209**

Case histories and performance data reports on numerous rubber products, including belting, hose and packings, are presented in a booklet, "Productioneered for Greater Output." V-belts, conveyer and flat transmission belts are dealt with. Types of hose include products for air, steam, water, welding, suction, chemical and fire protection. Quaker Rubber Corp.

Feeders & Rotary Valves **210**

Roll feeders for dry pulverized materials, vane type feeders for pulverized and granular materials, totally enclosed feeders with circular or rectangular flanges and rotary valves are described in 8-page catalog F-4. Capacities and specifications are tabulated. Fuller Co.

Belt Lacing **211**

Long length conveyer belt lacing is described in 2-page catalog sheet A-70. Advantages and typical applications are presented and sizes are listed. Flexible Steel Lacing Co.

HYDRAULIC EQUIPMENT

Oil Temperature Control **212**

Described in folder 3M-352-20 is an automatic temperature control designed for use with hydraulic fluid cooling systems. The method of installation is described. Specifications and other cooling applications are listed. Sterling, Inc.

(Continued on page 150)

Electric Power Drives **204**

Engineers concerned with electric drives for applications requiring variable speed, low speed or protective type enclosures should find 20-page brochure 174 a source of useful information. The booklet has been published to give the reader a clear picture of the design and construction features of totally enclosed, splash-proof and drip-proof motors, as well as variable speed drives and gear motors developed to meet a wide variety of applications. Subjects including ventilation, bearings, windings, rotor design, mounting and remote control are discussed and illustrated. Sterling Electric Motors.

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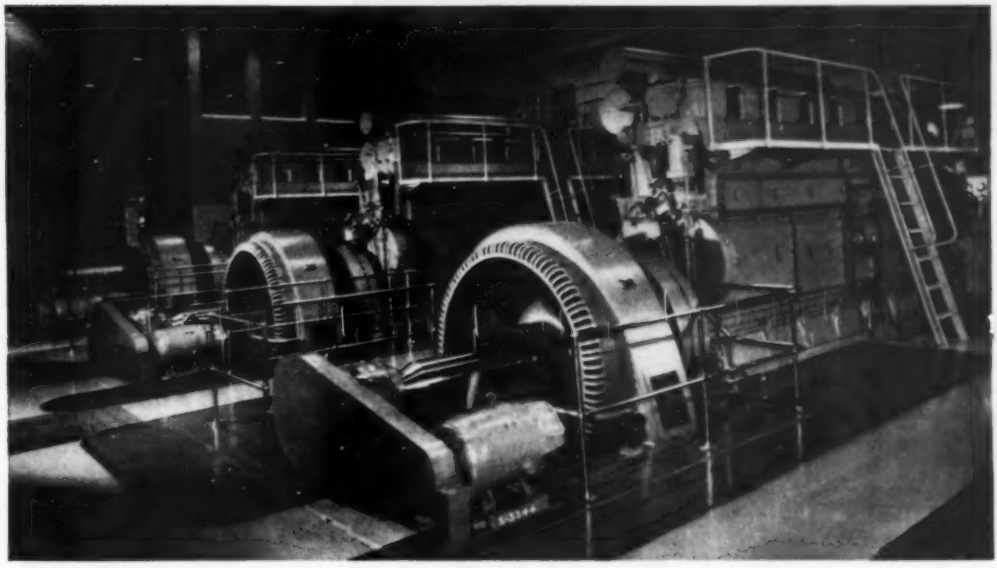


Three Worthington 1160-kw capacity supercharged dual fuel Diesel engines in the Pittsfield, Illinois plant of the Illinois Rural Electric Company—an REA cooperative.

Dual Fuel Engines at Illinois Rural Electric Company Hold Fuel Costs Down for REA Cooperative

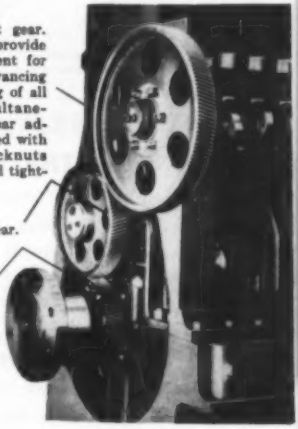
At present, the three Worthington Dual Fuel Engines at the new Illinois Rural Electric Company plant, just north of Pittsfield, are operating on oil. Later, when natural gas is available, they will operate as dual fuel units.

This REA cooperative serves rural consumers of electrical energy in an area of about 2,500 square miles in west central Illinois.

Although the plant is not yet fully loaded, engine performance has been in excess of 14 kwh per gal. of fuel oil with a load factor of 42 per cent. When engines are operating at full capacity, this performance will be even better.

Fuel consumptions on tests were as much as 6 per cent better than guarantees.

Worthington engines can always increase your plant's efficiency, lower your operating costs. For full facts on Worthington Dual Fuel or other engines, gas or Diesel, write Worthington Corporation, Engine Division, Buffalo, N. Y.

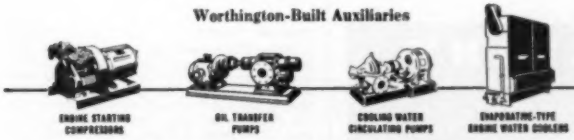

Main camshaft gear. Slots in gear provide single adjustment for retarding or advancing injection timing of all cylinders simultaneously. Final gear adjustment secured with castellated locknuts wired after final tightening.
Free floating idler gear.
Split gear keyed on crankshaft. Permanent adjustment for perfect alignment with idler gear is easily accomplished.

WORTHINGTON HELICAL STEEL GEAR TRAIN

1. Provides accurate and positive control of engine timing.
2. Location at flywheel end of engine results in smooth gear operation as power impulses are absorbed by the flywheel.
3. Controlled automatic oil-jet lubrication eliminates wear. Assures correct engine timing. Keeps engine running smoothly. Results in best fuel consumption and lowers engine maintenance.

E-2-9

Worthington-Built Auxiliaries



Economical Continuous Power—Diesel Engines, 150 to 2,100 hp . . . Gas Engines, 190 to 2,100 hp . . . Dual Fuel Engines, 150 to 2,100 hp.

WORTHINGTON
Engines

ELLIOTT TWIN STRAINERS
give double-barreled protection

SIZES AND BASKET MESH TO SUIT THE NEED

Fourteen sizes—1" to 24". Basket perforations, 1/32" to ⅜". If finer mesh is desired, basket can be lined with wire cloth. You get the straining service you need with Twin Strainers.

There is practically never any need to shut down a Twin Strainer. It provides its own standby service, thrown into operation by the two-way valves which shut off the fouled chamber.

For over a generation, Twin Strainers have been standard equipment in many industries. Now redesigned with many maintenance-saving features. Get the facts —write for the Twin Strainer Bulletin.

A-317

ELLIOTT COMPANY
Accessories Dept. • JEANNETTE, PA.
Plants at JEANNETTE, PA. • RIDGWAY, PA.
AMPERE, N. J. • SPRINGFIELD, O. • NEWARK, N. J.
DISTRICT OFFICES IN PRINCIPAL CITIES

New bulletins and catalogs

(Continued from page 148)

COMPRESSORS

Air Compressors **213**

Two stage, air-cooled radial air compressors for producing pressures of 80 to 125 psi are described in 12-page bulletin H-630-B1. Dimensions, sizes and weights of bare, base-mounted multi V-belt driven, base-mounted flexible coupled, and close coupled types are listed. Capacities and specifications together with discussion of construction features are presented. Air receivers and aftercoolers also are described. Worthington Corp.

FANS & BLOWERS

Fans **214**

Capacity tables, dimensions and descriptions of fans designed for specific applications are given in a series of 4-page folders: C-46P; C-46AP; C-46H; and C-46EX. Included are slow speed and load limiting types used primarily in heating, ventilating and air conditioning. A pressure blower is presented for industrial uses requiring small air quantities at high pressures. An industrial exhaust fan also is described. Bayley Blower Co.

Induced Draft Fans **215**

"Motorized Chimney Draft," bulletin I-52, describes draft inducers. The advantages of mechanical draft over natural

draft in supplying positive, uniform draft, regardless of weather or inadequate stack or breeching, are outlined. Elimination of tall, costly stacks also is discussed. L. J. Wing Mfg. Co.

CONTROLS, REGULATORS & INSTRUMENTS

Explosive Gas Detectors **216**

Four types of combustible gas protective instruments are catalogued in 4-page folder FSE1251. Included are a portable indicator, a portable audible alarm and two types of alarms for fixed locations. Principles of operation are discussed and specifications are tabulated. Johnson-Williams, Ltd.

Control Valves **217**

"New Techniques in Control Valve Design," 16-page technical paper 106, presents a review of the development of conventional control valves and predicts future designs. Outlined in the article are the underlying reasons for present designs and the logic behind those predicted. Photos and drawings supplement the text. Conoflow Corp.

Positioning Control **219**

Remote positioning control by a hydraulic system is outlined in 12-page bulletin 157. Principles of operation, applications, features and advantages of component parts are included. Engineering specifications and pointers on installation also are given. Farris Hydrotorque Corp.

ELECTRICAL DISTRIBUTION

Aluminum Bus Bars **219**

Enumerated in 4-page folder B-750 are the advantages and characteristics of aluminum as an electrical conductor. The story of how engineers adapted aluminum to electrical uses also is related. A chart comparing relative size, weight and performance of aluminum and copper in bus bars is featured. BullDog Electrical Products Co.

Wire & Cable **220**

Specifications for more than 500 types of wire and cable are contained in a 186-page general catalog. Data on construction and operating characteristics for such products as portable cords and cables, power cables, building wires and cables, and bare or waterproof wires are included. Also of value is a technical data section. United States Rubber Co., Electrical Wire and Cable Dept.

HOW TO REQUEST FREE BULLETINS

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ELECTRICAL INSULATION

Electrical Tape **221**

Listed in 4-page folder P-1 are three types of electrical tapes. These include a four coated friction tape, a quick fusing high-dielectric rubber tape and a plastic electrical tape. Advantages, applications, characteristics and sizes are given. Ideal Industries, Inc.

ENGINES

Gas Engines **222**

Totally enclosed spark ignition gas engines of 5, 6, 7 and 8 cylinders are described in 8-page bulletin S-550-B18A. Specifications and principal dimensions are listed for a four cycle unit having a 15 in. bore and a 17½ in. stroke. Brief descriptions of other models also are included. Worthington Corp.

LUBRICANTS, LUBRICATION, OIL FILTERS & PURIFIERS

Oil Purifiers **223**

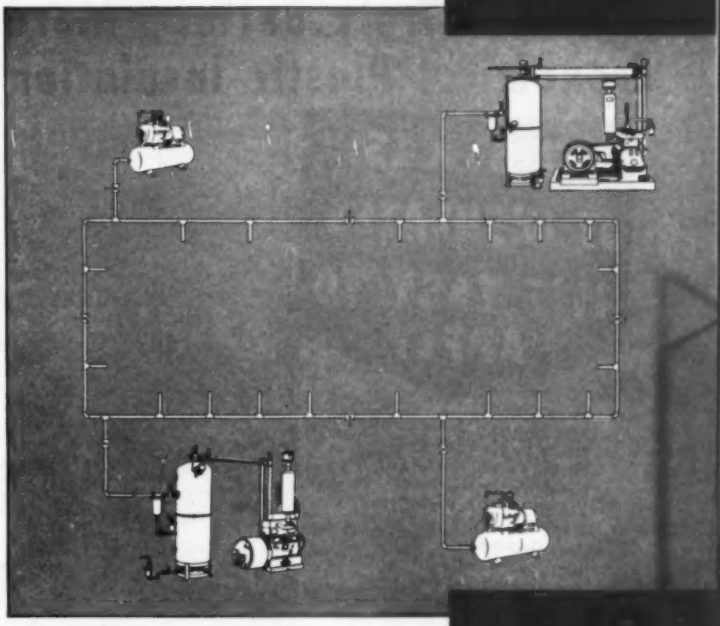
"Proven Protection Against Oil Failure" in diesels, turbines, transformers, circuit breakers, switch gear and other oil-filled equipment is the subject of an 8-page booklet. Various types of oil purification equipment are described. Advantages and specifications are listed. Honan-Crane Corp.

Oil Filters **224**

Filters for most lubricating, fuel and industrial oils are described in 8-page bulletin HF. Included are construction and design details, comparison with other types and service instructions. Tables and charts contain engineering data for selection of equipment. The Hilliard Corp.

(Continued on page 152)

HOW TO SAVE MONEY ON YOUR... AIR COMPRESSOR INSTALLATION



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3. Low in maintenance cost. The unit system allows you, when one of the compressors is shut down for minor repairs, to continue operating the other compressors without affecting the overall capacity of the plant to any appreciable extent. *For full details write us today.*

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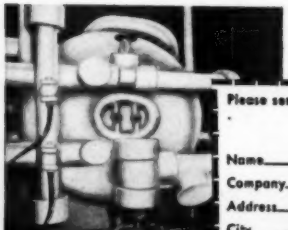

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New bulletins and catalogs

(Continued from page 151)

FUELS & FIRING EQUIPMENT

Oil Burner Controls **225**

"Oil Burner Controls Handbook," 48-page pocket size booklet OB, presents information on controls for such functions as temperature, pressure, dampers and fans, as well as controls for oil burners. Construction of equipment, wiring diagrams, installation instructions and service hints are given. Comparison charts for competitive controls aid in selection of replacements. The Mercoid Corp.

HEAT EXCHANGER EQUIPMENT

Cooling Towers **226**

Details of construction, charts, suggestions on recirculation, and the influence of surroundings are discussed in a 36-page booklet describing mechanical draft cooling towers. A cross-sectional drawing is employed as a quick reference index to descriptions of each component part. Foster Wheeler Corp.

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MATERIALS OF CONSTRUCTION

Grating **227**

Charts and load tables are contained in the engineering data section of 24-page booklet, "Open Steel Grating and Stair Tread Catalog." Descriptions of various types of grating include a recently developed welded grating having round steel cross bars. Klemp Metal Grating Corp.

MOTORS & GENERATORS

Induction Motors **228**

Various designs of high-horsepower wound rotor or squirrel cage polyphase induction motors are described in 6-page folder 37-200. Advantages of each type are discussed. The Electric Products Co.

Worm Gear Motors **229**

Design features of right angle worm gear motors are discussed in bulletin 1650. Cutaway views illustrate construction and advantages are discussed. Upright, variable speed and flange mounting types are described for single or three phase service. Speeds from 20 to 155 rpm with gear ratios up to 58 to 1 are available. Ratings are ¼ to 3 hp. Splash proof and totally-enclosed models also are available. U. S. Electrical Motors Inc.

PACKAGED STEAM GENERATORS

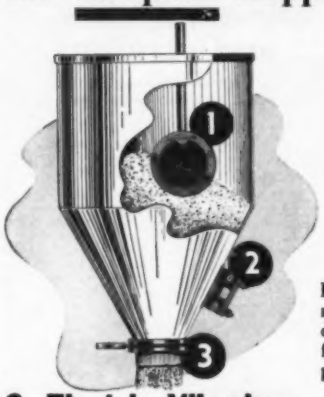
Packaged Steam Generator **230**

Described in a 4-page folder is the principle of Cyclonic Combustion, a recently developed method of heat transfer employed in a packaged steam generator. A question and answer section is used to provide information concerning the unit. Oil, gas or combination burners are available. Capacities are from 18 to 500 boiler hp. Cyclotherm Corp.

(Continued on page 154)

for Complete Hopper Efficiency—

SYNTRON



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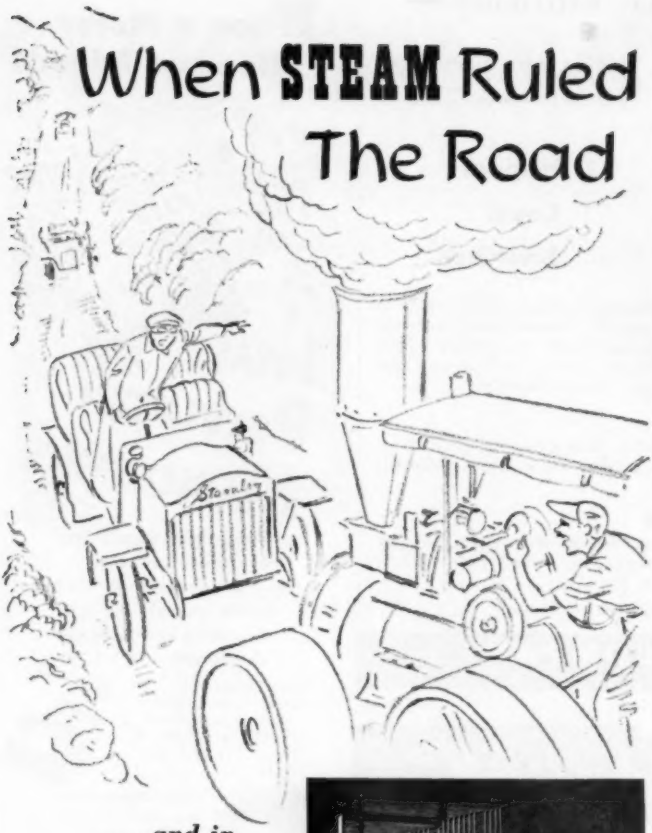
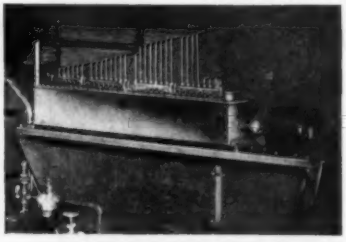
When STEAM Ruled The Road



... and in modern industrial plants



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New bulletins and catalogs

(Continued from page 152)

PACKINGS & GASKETS

O-Rings **231**

Data of value when selecting seals for either static of dynamic applications are presented in "O-Rings . . . Design, Manufacture and Application," a 16-page booklet. The general properties of various synthetic and natural rubbers are tabulated and a discussion of basic rubbers is included. Applications are described and specifications for different types of packing are listed. Graton & Knight Co.

PIPE & FITTINGS

Industrial Hose **232**

Five basic types of color coded multipurpose industrial hose, developed to replace 18 types formerly offered, are described in 8-page bulletin 3680. The publication gives details of construction, sizes, pressures, recommended couplings and uses. Thermoid Co.

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Flexible Metal Hose **233**

Catalog CMH-130, 32 pages, lists many styles of flexible metal hose, including corrugated and stainless steel types. Descriptions, specifications and applications are given. Also covered are coupled types, special assemblies and installation information. Flexonics Corp.

PUMPS

Centrifugal Pump **234**

Seals and stuffing boxes are eliminated in a recently developed centrifugal pump described in a 4-page folder. A large cutaway view shows construction details. Many advantages gained by the new design are outlined. According to the bulletin, the unit will handle any clear liquid and many slurries. Chempump Corp.

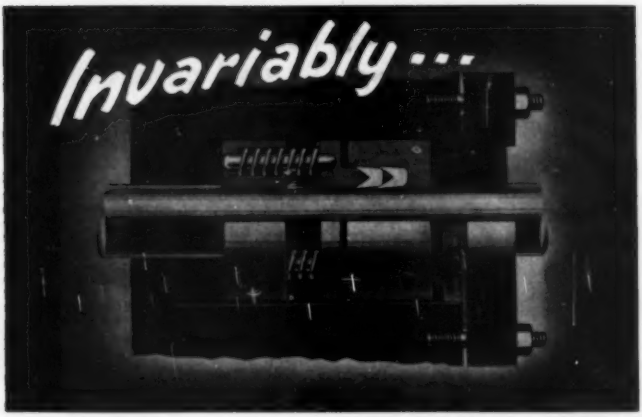
Chemical Transfer Pump **235**

Described in 6-page folder B-1606 is a semi-open impeller centrifugal pump for continuous or intermittent light duty in transferring process chemicals. Construction and advantages are described. Capacity, listed in a specifications table, ranges from 10 to 250 gpm for heads of 10 to 140 ft and temperatures to 250 F. A unit for higher pressures, temperatures and capacities also is described. Food Machinery and Chemical Corp., Peerless Pump Div.

Proportioning Pump **236**

An explanation of the operation and advantages of reciprocating mechanical drive metering and proportioning pumps is given in 20-page brochure UP-52. Advantages and construction details are discussed. Technical information on how to select the proper unit as well as service recommendations for handling over 300 substances is presented. Special construction for unusual requirements also is dealt with. Hills-McCanna Co.

(Continued on page 158)



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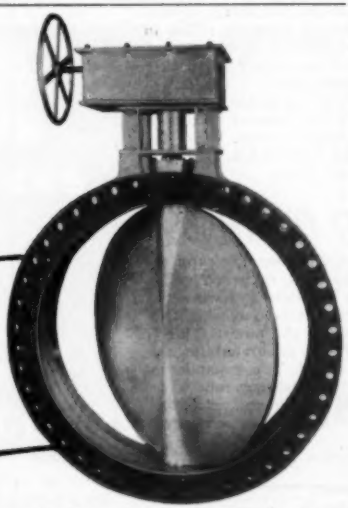

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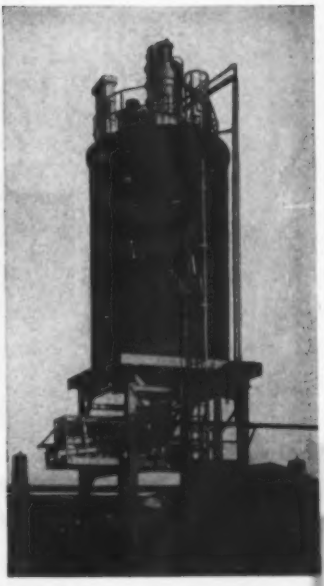

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There's an AIRETOOL Tube Cleaner and Tube Expander for every type of Tubular Construction

BRANCH OFFICES: New York, Philadelphia, Chicago, Houston, Tulsa, Baton Rouge

New bulletins and catalogs

(Continued from page 154)

Centrifugal Pumps **237**

Integral construction of pump and motor is featured in the design of a close coupled centrifugal pump described in 8-page brochure 200-B. Advantages are discussed. Mounting in any position is possible, according to the bulletin. A selection table lists capacities of 30 to 110 gpm with heads of 110 to 200 ft. Dimensions are tabulated. Useful tables listing friction of water in pipes and fittings also are presented. Carver Pump Co.

SOOT BLOWERS & TUBE CLEANERS

Retractable Soot Blower **238**

Engineering details of a long retractable soot blower are outlined in 8-page bulletin 1002. Air or electric drives are listed, and either steam or air can be used as the blowing medium. How it operates and advantages are discussed. Inspection, adjustment and repair also are dealt with. Continental Foundry & Machine Co., Copes-Vulcan Div.

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TOOLS

Hydraulic Conversion Unit **239**

Described in 12-page bulletin 97-108A is a unit for converting the company's pulling sets to hydraulically powered systems. Suggested uses, methods of application, advantages and specifications are outlined. In addition to puller sets, the unit can be adapted to such equipment as jack screws, bench presses, pedestal presses and sleeve puller units. Owatonna Tool Co.

TRANSFORMERS

Air Cooled Transformers **240**

Construction, specifications and applications of various sizes and types of dry type transformers are outlined in 8-page bulletin 748A. Applications also are described. Units ranging from ¼ kva, single phase to 2000 kva, three phase are shown. Several transformers designed for special applications also are presented. Sorgel Electric Co.

Unit Substation Transformers **241**

Form EU-106-8, a 4-page folder, contains a quick reference table of standard accessories furnished with the company's liquid-filled unit substation transformers from 112½ to 2000 kva. Such items as gages, thermometers, valves, tap changer and provisions for installation are described. Wagner Electric Corp.

Dry Type Transformers **242**

General construction, specifications and descriptions of dry type transformers for industrial control are presented in 8-page bulletin T-5111. Engineering data are listed in the form of graphs, tables and diagrams. Special transformers such as motor starting reactors and auto transformers also are described. Hevi Duty Electric Co.

(Continued on page 158)

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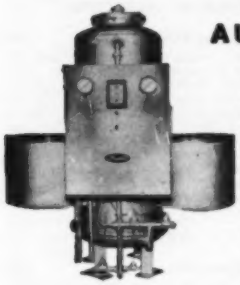
For Boiler Feed, Process & Other Needs



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New bulletins and catalogs

(Continued from page 156)

THERMAL INSULATION

Industrial Insulations **243**

Industrial insulation products are the subject of 20-page catalog J-1,Rev. Insulating products including cement, block, blanket, felt and pipe covering, which cover a temperature range from -150 to 1800 F, are described. Descriptions of applications together with typical uses, sizes, packages and densities are a part of the publication. Useful data, including thermal-conductivity graphs and heat loss charts, are presented. Baldwin-Hill Co.

VALVES

Heating Specialties **244**

How to design a one-pipe hot water system is explained in 8-page booklet J-355. In addition to discussions, data tables and diagrams are included. Many types of heating specialties are described, including a circulator, flow valves and fittings, relief valves, vents, a charging valve and compression tank. The Trane Co.

HOW TO REQUEST FREE BULLETINS

Insert "key" numbers on return post card found on page 131. Our Reader's Service Department will handle your request promptly

Check Valves **245**

Hydraulic double cushioned check valves are the subject of 2-page data sheet WS-1. Drawings are used to show complete list of parts. Application, construction, sizes and pressures are described along with tables giving general dimensions. Golden-Anderson Valve Specialty Co.

WATER TREATMENT

Purity Meter **246**

"How Pure is Your Distilled Water?", pamphlet 125, describes a recently developed electronic testing device for determining purity of distilled or demineralized water. How it operates, how it is used, and specifications are outlined. Accessories are listed. Also described is an automatic conductivity diverter which permits only water of a predetermined purity to enter a storage tank. Barnstead Still & Sterilizer Co.

Pressure Type Filters **247**

Details of design and construction of pressure type filters for removal of visible suspended matter from water are outlined in 12-page brochure WC-107. Various available arrangements of valves and piping and aids in their selection, are discussed. Typical installations are shown. Tables of capacities, dimensions and weights for both horizontal and vertical type filters are included. Graver Water Conditioning Co.

MECHANICAL POWER TRANSMISSION

Variable Speed Drives **248**

Upright and horizontal variable speed drives, closed or skeleton types, from 1/3 to 7 1/2 hp are described in 16-page bulletin AS-1600-B6. Advantages, design features, principle of operation and method of changing belts are discussed. Of particu-

lar interest is a section giving data for drive selection and tables of dimensions as well as discussions of operation and maintenance. Worthington Corp.

Transmission Belting **249**

Engineers concerned with the design and operation of transmission belting should find 16-page booklet NY-8697-T a useful source of information. In addition to several pages of fundamental data concerning selection and application, tables give belt speeds, horsepower correction factors and other pertinent information. New York Belting & Packing Co.

Flexible Couplings *

Engineering catalog 51 should be of value to engineers concerned with all metal flexible couplings. Data such as ratings, service factors, dimensions and loads for units from small motor couplings to large industrial applications are given

in a 78-page loose leaf binder. Keyway data and standards for straight and tapered bores also are included. ***Please send requests on company letterhead directly to Thomas Flexible Coupling Co., Dept. IP, Warren, Pa.**

V-Link Belting **250**

Facts concerning V-link belting are outlined in data book 205. Comparisons with endless V-belts and other detachable V-link belts are presented. Useful data including a selection table with power correction factors, tables of sizes and facts concerning assembly, and instructions for installation and maintenance are given. Brammer Corp.

Reviews of EXTERNAL HOUSE ORGANS

For a regular copy of a particular house organ, write direct to company

The Reporter

How chemicals are employed by a variety of industries is the general theme of a 28-page bimonthly publication. Descriptions of the processing of wine, pressed wood and leather, together with a discussion of water conditioning, were among the articles included in a recent issue. Rohm & Haas Reporter, Washington Square, Philadelphia 5, Pa.

Fairbanks-Morse News

Published bimonthly, this house organ contains many interesting articles concerning the installation of such equipment as pumps, motors, diesel engines and industrial scales. Several pumping stations, a municipal electric plant and the use of diesels for standby current are a few of the subjects dealt with in 24-page Vol. XXVIII, No. 4. Fairbanks-Morse News, Fairbanks-Morse Building, Chicago 5, Ill.

Kuhlman Kurrents

Information of value to engineers concerned with electrical distribution is contained in the technical articles of this 8-page quarterly periodical. A typical article, "Impulse Testing of Transformers," appears in Vol. 23, No. 2. The Kuhlman Electric Co., Bay City, Mich.

—*End*

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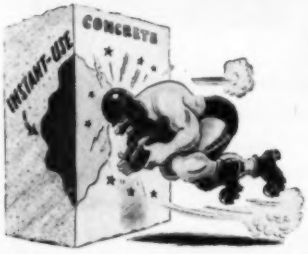

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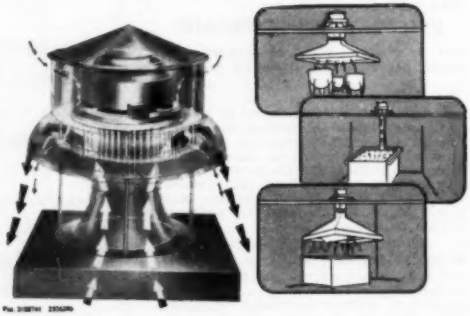

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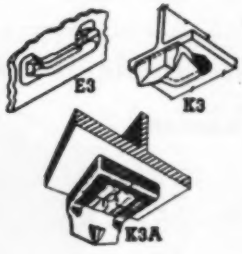

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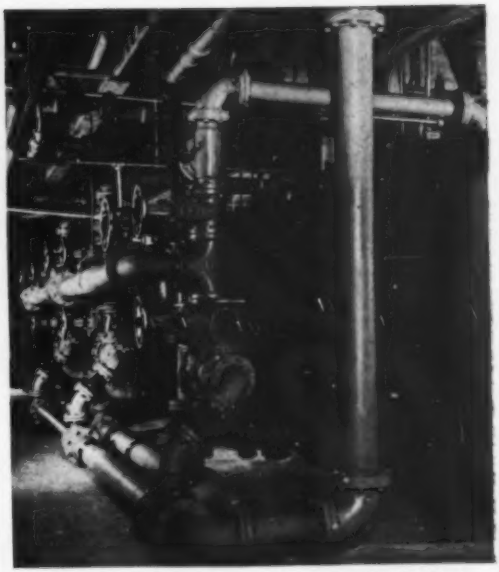

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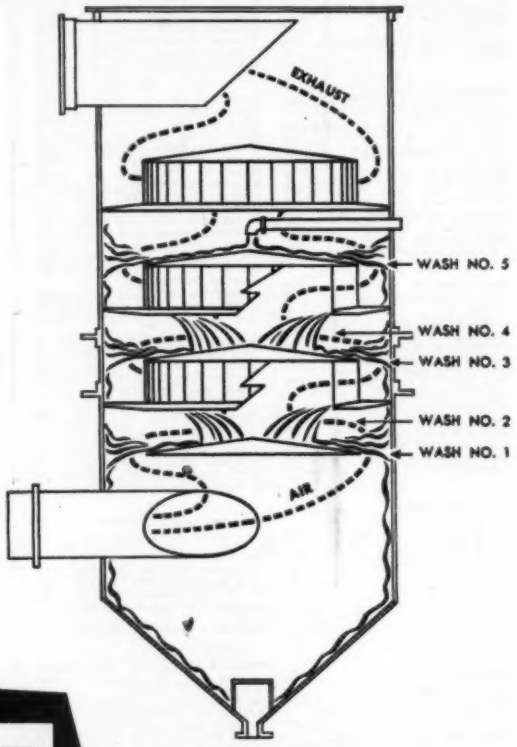

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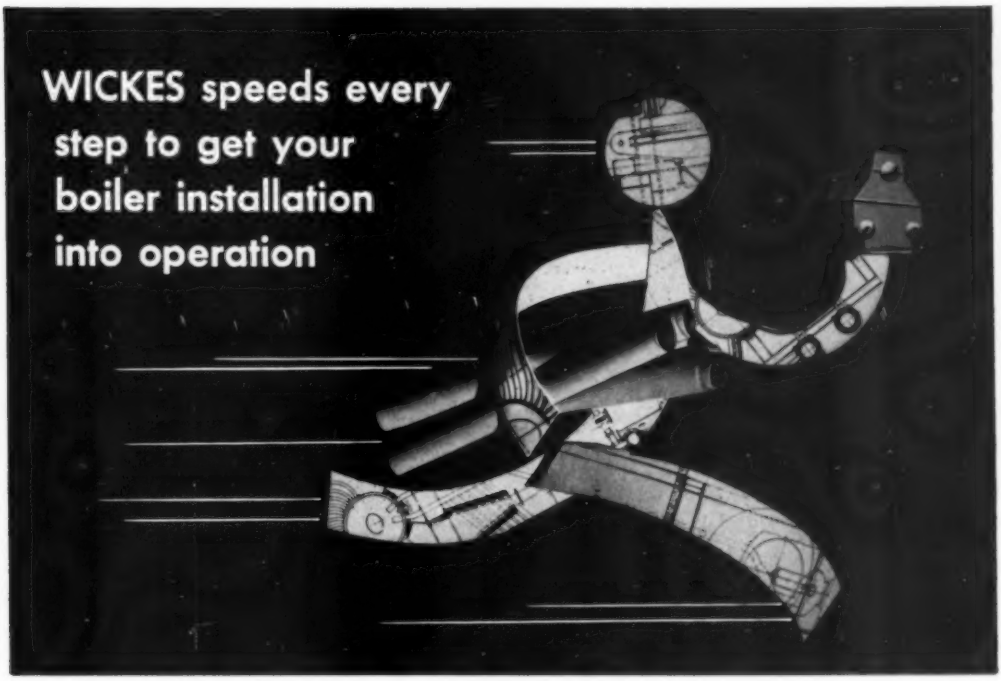

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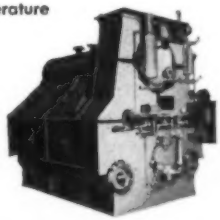

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